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National Resources Inventory (NRI)

Colorado Pilot Test 1997-1998

DRAFT
Report

March 1998

Results • Lessons Learned • Recommendations for Future Use

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Draft

Executive Summary

The National Resources Inventory (NRI) has long been used by the Natural Resource Conservation Service (NRCS), formally the Soil Conservation Service (SCS), to determine trends in land use conversions, cropping change, conservation needs, and resource conditions on private lands for the last 30 years. The NRCS has extended the opportunity for other agencies and entities to utilize NRI as a means to provide needed information on other land ownerships.

There are two ***primary reasons*** why BLM piloted a test of the NRI in 1997-1998. 1) The condition of the public lands has long been a national debate, with interest groups and individuals expressing widely disparate views on the overall health of the public range lands from "all is well" to "apocalypse now." Data that has been collected varies widely between states and is vulnerable to challenge. 2) Section 201(a) of the Federal Land Policy and Management Act and Section 4(a) of the Public Rangelands Improvement Act require BLM to inventory public lands and, in particular, develop and maintain an inventory of range conditions and trend on public rangelands updated on a regular basis. The NRI appears to have the capability to address these concerns.

The NRI pilot project ***objectives*** were to:

1) Test the National Resource Inventory (NRI) approach to monitoring resource data and other trends on public lands administered by BLM.
2) Determine if NRI, or some variation, is appropriate to meet BLM's and other federal public lands continuing inventory requirements under Section 201 of the Federal Land Policy and Management Act (FLPMA).

There were three ***major features*** that guided the project design.

1) Test the operational aspect of conducting the inventory on public land landscapes,
2) Produce a product that provides some information about the resources on the lands managed by BLM. (The pilot test was not designed to provide site-specific information such as what might be needed for a grazing allotment.
3) Assess what resources and budget would be needed to conduct a full NRI program on public lands. Included is an assessment of what costs and resources would be needed to gather data under NRI to achieve various reliability indexes (i.e., what would it cost to achieve an 80% confidence level at the Major Land Resource Area (MLRA) level?; to obtain an 85% confidence level?, etc.)

A technical team consisting of resource specialists from BLM, NRCS, and the Forest Service developed inventory protocols within the NRI framework. The protocols were developed with "land health" as a guiding principle, identifying quantitative and qualitative assessments that could be correlated and possibly measured. Because of time constraints, the technical team was unable to fully test the protocols prior to the field season.

The inventory was conducted by four, 3-person crews in western Colorado from June until mid-October of 1997. The crews collected data on 448 Primary Sampling Units (PSUs) and points. The crews were comprised of employees from BLM, NRCS, and the Forest Service. Some were hired under temporary appointments while others were detailed to the project. The first month the crews struggled with untested protocols in unfamiliar landscapes. Throughout the summer, the crews continually struggled with completing the work without compromising safety and quality of data collection.

Realistically, the project should have been conducted over a two year period. Nevertheless, some valuable lessons were learned especially pertaining to the operational aspects of conducting the inventory. Details of all the operational aspects of conducting the pilot are contained in the report. Some ***key points and findings*** are:

* The operational costs to conduct the pilot test was $400,547. (If you include costs associated with the Technical Team, Washington Office overhead, and other labor contributions, the total cost for the project is estimated at $941,000.)
* The estimated cost per inventory point is $893. Once weighting information is received from Iowa State University, an estimate can be made as to the number of points that would be needed to achieve 80% reliability. The cost per acre can also be calculated with that data.
* The inventory (and its development) should be a partnership among federal land management agencies. The roles and responsibilities of each agency should be well-defined and formalized in an agreement.
* The inventory should be on-going and spread over several years. Consider the inventory a marathon, not a sprint.
* An adequate support structure consisting of persons responsible for project leadership, quality control, and operations/logistics must be identified and committed to.
* The field inventory is best completed by a three-person crew consisting of a soil scientist, ecologist, and resource technician. To assure consistency, the appointments of the soil scientist and ecologist should be permanent employees.
* It is critical to allow for adequate time to gather ancillary support data, hire crews, and organize/assemble the necessary support structure before field work begins.
* The inventory should not be conducted without Personal Data Assistants (PDAs).
* Before field collection, assure that soils data (mapping, descriptions, etc.), and range/ecological site descriptions are available.
* The training of crews must not be "short-changed."
* The crews in the pilot project continually struggled to complete the inventory while maintaining quality. Quality control is essential for the success of the inventory.
* Travel is a major cost of the inventory. Time spent in logistical planning will pay long-term dividends.
* The relationship of existing and projected remote sensing technology with the field data collected in the test needs to be analyzed.

Dr. Kenneth Spaeth, Rangeland Hydrology Specialist with NRCS (Northwest Watershed Research Center, Boise, Idaho), is providing leadership in the ***analysis of the data***. The objective is to simultaneously evaluate plant community (plant species composition and various vegetation assemblages) and other inventory factors (environmental, range health factors, conservation practices etc.) A multi-variate analysis will summarize the 1997 NRI study and reveal trends and correlations in the data. The aim of the analysis is to discover the underlying order of existing vegetation and all factors attributing and affecting conditions and trends. The information will help identify resource strengths and weaknesses on public lands.

To meet the deadline for the preliminary draft report and still show what types of information and correlations are possible, a decision was made to concentrate the initial analysis on data that was collected in one Major Land Resource Area (MLRA). The MLRA selected was #34 - "Central Desertic Basins, Plateaus, Foothills, and Mountains." This MLRA boundary encompasses land in west-central and northwest Colorado and extends into Wyoming and Utah. Data on approximately 103 Primary Sampling Units (PSU) in MLRA 34 were collected in the pilot test.

The initial phase of the analysis was designed to addressed the following:

- * Summarize the state of MLRA 34, based on the 1997 inventory.
- * Examine plant community composition and rangeland health attributes.
- * Evaluate soil health with other environmental factors and plant composition.
- * Evaluate watershed status and identify factors associated with watershed health.
- * Calculate similarity indices for the respective NRI points and correlate with other factors.
- * Identify and interpret plant-soil-environmental relationships on the MLRA level.
- * Identify noxious weed problems and potential future noxious weed problems.
- * Evaluate correlations between urban and build-up areas, roads, water developments, and streams with overall landscape conditions.

A total of 149 inventory points were sampled in MLRA 34. The initial phase analysis addressed the 149 CRI points at several hierarchial levels. Dr. Spaeth performed a variety of correlations and constructed models that will allow BLM managers and planners to evaluate the data in many ways. For example:

1) Environmental correlations were made with various kinds of conservation practices. For example, many of the rangeland health attributes such as rills, water flow patterns, pedestals caused by erosion, gullies, etc.,e plants, and plant recruitment and reproduction) were correlated with conservation practices (planned grazing use, seeding, fencing, chaining, burning etc.).

2) Ecological correlations were made with environmental data and types of management (conservation practices) applied. (There are many combinations of ecological / environmental / management interactions that can be evaluated.)

The preliminary results of the analysis have demonstrated that NRI has the capability to provide a wealth of data that can be correlated and modeled to provide managers with information on resource strengths and weakness on the public lands that BLM manages. What is yet to be determined is:

1) Does BLM believe the information sufficiently meets BLM's needs?, and

2) Is it worth the cost to gather the data?

Recommendation: The BLM needs an inventory to measure rangeland health, condition, and trend that is standardized, scientifically sound, statistically accurate, unbiased, and credible. That inventory should be universally accepted by the federal agencies that manage wild lands. The NRI can fill that need. Accordingly, BLM should pursue the use of NRI but only if BLM, NRCS, and the USFS formally agree to pursue the use of NRI for the rangelands they manage. (It would also be desirable to include the USFWS, NPS, and the Department of Defense (DOD) in the agreement.) The BLM must be a leader in this effort to assure that the agency's needs and requirements are met.

If an agreement can be reached, BLM should proceed as follows:

1. Establish an interagency technical group of experts in remote sensing techniques to review the data collected in the Colorado NRI Pilot. The purpose of the group is to determine what information and data collected during the pilot project may be gathered with remote sensing technology. Correlations between the remote-sensed information and the field-collected information may be sufficient to make significant reductions in the requirements for on-the-ground data gathering.

2. Use the technical team and other resource experts to review all of the data and correlations from the Colorado pilot project and assess the needs/opportunities to improve the results. Upon completion of the review/assessment, rewrite the handbook with a final set of protocols. This should be completed no later than February 1, 1999. The critical factor is that the final protocols must be done in time to ensure that the PDAs are programmed and functioning for the FY2000 field season. No further NRI field work should be conducted until the data can be recorded into programmed, sufficiently tested PDAs.

3. When the data becomes available, estimate the cost to conduct NRI on all federal lands.

Officials from cooperating agencies must decide whether or not to proceed with NRI after weighing the benefits of the information against the costs.

If the decision is to proceed with NRI, BLM should proceed as follows:

1. Beginning in FY99, begin a two or more year funding stream for the completion of the data gathering for the statewide Colorado NRI. During the first year, conduct pre-work. Gather data and conduct analysis during the second and subsequent years. Also, select one or two other states having the best combination of completed soil surveys and high quality ecological site descriptions and fund those states to complete an NRI inventory over a minimum of three years. The general time frame to conduct the inventory is as follows: Year 1- identify points, gather soils data, gather/buy aerial photos, etc. Year 2 - data collection and determination of the sample size to reach the desired confidence level. Year 3 - field data collection and data analysis.

2. Establish an on-going technical team that will monitor changing technologies, including the declassification of Department of Defense imagery, and develop uniform intra-agency standard modifications to the NRI process to make it better and less costly. This modification process must be done in a way to ensure compatibility and usability of the historical NRI data to enable scientific documentation of trends in rangeland vegetation and soil stability.

3. It appears that Iowa State University is being stressed by the addition of the Colorado Pilot NRI. Therefore, establish a partnership with a western academic institution with strong programs in wild land management to process and analyze the NRI data from the public lands.

I. Introduction

A. Overview of the National Resources Inventory

The National Resources Inventory, or NRI, is an inventory of land cover and use, soil erosion, prime farm land, wetlands, and other natural resource characteristics in the United States. The NRI also provides a record of the Nation's conservation accomplishments.

Led by the Natural Resource Conservation Service (formerly the Soil Conservation Service), the NRI was conducted in 1982, 1987, and 1992. The NRI has an established infrastructure for data gathering/analysis. The data base is nationally consistent, statistically reliable, scientifically recognized, and credible with the public. The NRI is also adaptable to meet changing needs (i.e. the 1992 NRI was not exactly the same as the 1987 project which was not the same as the 1982 project.).

Several legislative acts (1972 Rural Development Act, 1977 Soil and Water Resource Conservation Act, and 1985 Food Security Act) broadly mandate that a national inventory of the Nation's resources be established and maintained. The NRI fulfills this mandate and provides information that can be used for formulating policy and developing natural resource conservation programs at the national or state level. The NRI is conducted every five (5) years to evaluate existing programs, propose potential new programs, and allocate resources.

B. Why Colorado BLM Conducted a Pilot Test of NRI

There are two major reasons why BLM piloted a test of the NRI.

1) The condition of the public lands has long been a national debate, with interest groups and individuals expressing widely disparate views on the overall health of the public range lands -- from "all is well" to "apocalypse now." Data that has been collected varies widely between states and is vulnerable to challenge.

2) Section 201(a) of the Federal Land Policy and Management Act and Section 4(a) of the Public Rangelands Improvement Act require BLM to inventory public lands and, in particular, develop and maintain an inventory of range conditions and trend on public rangelands updated on a regular basis.

The NRI appears to have the capability to address these concerns. However, to date the NRI has been conducted on private lands and the majority of the lands have been crop land. The objectives of the pilot project were to: 1) test the NRI approach for monitoring resource data and other trends of public land administered by BLM; and 2) determine if NRI or some variation is appropriate to meet BLM's continuing inventory requirements.

C. What the NRI Pilot Test Intended to Accomplish

The pilot test was designed to accomplish the following:

1. Examine the operational aspects of what it will take to conduct all stages of NRI including analysis of data on public lands administered by BLM.

2. Produce a product that provides some District level (or greater) information about the resources on the lands managed by BLM. The pilot test was not designed to provide site-specific information such as what might be needed for a grazing allotment.

3. Determine the statistical design that would be needed to conduct a full NRI program on public lands. Included will be an assessment of what costs and resources would be needed to conduct NRI to achieve various reliability indexes (i.e., what would it cost to achieve an 80% confidence level at the Major Land Resource Area (MLRA) level?; to obtain an 85% confidence level?, etc.)

D. The Purpose of This Report

The purpose of this report is to disclose the findings of the test and provide recommendations on the future utility of NRI to meet BLM's on-going inventory requirements.

II. Background

A. Decision to Conduct a Pilot Test

As previously mentioned, the condition of the public lands has long been debated. Current and past reporting practices have resulted in widely varying, inconsistent data between states. A more consistent approach is needed that will mitigate BLM's reporting problems. It appeared that utilization of a national inventory system that is already in place and considered successful - the NRI - would be a good starting point for the following reasons:

* it has a broad congressional mandate,
* it has a history (conducted in 1982,1987, and 1992),
* it is currently operational,
* it appears to be adaptable to meet changing needs,
* there is an established infrastructure for data gathering and analysis,
* the data base is consistent nationally, statistically sound, scientifically recognized, and has some public credibility, and
* the sampling cost per unit area is generally low (at least for private lands).

Some other aspects of NRI that made it intriguing as a potential method/process to meet BLM's continuing inventory requirements are:

* accounts for changes in condition of resources over time,
* depicts status and trends over broad areas,

* provides national accounting of soil and vegetation resources,
* can evaluate rangeland health using ecological indicators (based on one previous test),
* depicts regional trends and magnitude of problems,
* provides an automated, interactive data base,
* provides a platform into which data from other sources may be integrated,
* adapts to the information needs and capacities of its users,
* yields readily marketable information, and
* can provide answers to Congress and the public about rangeland status.

It is acknowledged that NRI will not replace site-specific/localized monitoring.

In April 1996 BLM and NRCS officials in Washington discussed the potential of being partners in a pilot project to test the application of the NRI on public lands. In July 1996 Maitland Sharpe, BLM Assistant Director for Resource Assessment and Planning, decided to fund a pilot project in 1997-1998 to test NRI on public lands administered by BLM. Concurrently, NRCS Washington Office officials agreed to partner with BLM in the test by providing technical and staffing support, programmed Personal Data Assistants (PDAs), and a sample design with inventory sites by January 6, 1997.

It was decided to test NRI statewide. Colorado BLM was selected because of:

* diversity of habitats,
* diversity of land ownership,
* location of principal affected and interested offices in Denver: the USFS Regional office, BLM Colorado State Office, BLM NARSC, and NRCS state office in Denver,
* 90%+ coverage of the state by Soil Technical Guides, and
* Colorado BLM management and staff support.

The Colorado pilot project was designed to:

* obtain sufficient data so that statisticians can provide BLM with various alternative sampling scenarios at alternative reliability levels,
* determine what it would take for BLM to conduct an ongoing NRI-type program, and
* provide some general District-level information on resource conditions for BLM-managed lands.

A national interagency agreement (IA) between BLM and NRCS was initiated but not finally signed until September 9, 1997. See Appendix A. Because the IA was not signed before the project began, there was confusion concerning some of the roles and responsibilities of each agency.

B. Selection of the Project Manager

In October 1997, Dennis Zachman, Land Use Planner in the BLM Colorado State Office was selected to be project manager. His formal education was in recreation management and planning. He has more than 23 years of experience with BLM having held a variety of positions including supervision and management. His selection as project manager raised some concerns because he did not have educational or specialist experience in soils science, ecology, botany, or range conservation. However, the selecting officials felt that Mr. Zachman's project management skills and diverse experience would be an asset to the project as long as he was surrounded with quality technical experts.

C. Kick-Off Meeting - Craig, CO

On October 22-23, 1996, officials and staff from BLM, NRCS, Agriculture Research Service (ARS), and the Forest Service met in Craig, Colorado to kick-off the pilot project. The session served to demonstrate each agencies' commitment to the pilot project, provide additional information and insight into NRI, provide a field site demonstration, and identify preliminary roles and responsibilities for the project.

D. Development of a Plan of Action

A plan of action was developed in November 1996 and periodically updated to reflect changes. Each updated version highlighted what changes were made to the original plan in the appropriate section so that the reader could see what the changes were. Appendix A is copy of the most recent Plan of Action (revised November 11, 1997.)

E. Selection of the Technical Team and Resource Area Contacts

An interagency technical team was selected in October 1996 to provide the necessary technical support to the project manager. The roles and responsibilities of the technical team were to:

* Define the processes and procedures to be used in the gathering of the data.
* Identify interrelationships, connections, and possible linkages between this project. and other projects being conducted in BLM and other agencies.
* Assist in defining desired products from the data.
* Assist in data analysis to determine future utility of NRI or some variation of NRI.
* Equip field crews with adequate resources in order to conduct accurate inventory.
* Train field crews to conduct inventory.
* Provide quality control and assure consistency.

Each BLM Resource Area office selected a specialist to assist with the pilot project (i.e., Resource Area Contact). Responsibilities of the Resource Area Contact included the following:

Logistics:
* Assist in finding work space, office equipment, and services for crews.
* Introduce crews to key persons in the resource area.
* Work with crews on check in/check out procedures when they are in the area.
* Determine access situations to the PSU (both physical and legal); help resolve access needs and provide best access routes to the PSU.
* Contact ranchers and other lessees of lands on which the PSUs lie.
* Provide insight into local conditions regarding lodging, campgrounds, etc.
* When the crews are working in the resource area, coordinate on schedules and PSUs to be visited.
* Arrange for times and places for accessing a personal computer.

Ancillary Data: (provide the following):
* Provide any needed maps (note: the CSO gathered most of this information but the contact was to supplement maps as needed).
* Provide any aerial photos.

* Identify any affected plans that cover the PSUs.

Other Assistance:

* Coordinate with local NRCS staff on the project and crew needs.
* Assist in the identification of plant species that crews may not be able to determine in the field.
* Provide an alert on possible T&E species and identification.
* Serve as a conduit for information about the NRI project to other staff.
* Resource area contacts located in town where the crews were duty stationed had some additional operational and administrative duties.

Appendix C lists members of the technical team, resource area contacts, and other critical project contacts.

F. Development of the Protocols

The first major task of the project was to develop protocols. The project manager was instructed that the protocols needed to be developed by December 17 to coincide with decisions being made for the "regular" NRI being conducted by NRCS in 1997. On November 18 and 19, the technical team met at the BLM Colorado State Office. The objectives of the meeting were to :

* review NRI data elements and protocols,
* identify required data needs for BLM in the pilot project,
* identify issues and concerns regarding data elements and data gathering procedures, and
* develop recommendations to the NRCS on proposed modifications and additions.

When the technical team met, the data elements for the "regular" 1997 NRI were not developed. Assuming the base data would not change significantly from that collected for the 1992 NRI, the data element forms for 1992 were used as the basic framework to display the pilot project recommendations. In addition, rangeland health forms and protocols that had been developed as part of an interagency effort were also used. The team was successful in meeting the December deadline. Although numerous requests were made to NRCS for a final decision on the proposed protocols, no formal decision was ever made. Nevertheless, the team moved forward with the proposed protocols. After several teleconferences and a meeting held in Denver on March 6-7, 1997, "final" project protocols were produced. (The reason the term "final" is in quotations is that as the project progressed, the protocols were modified and changed when appropriate). Appendix D contains notes of the March 6-7 meeting that include the decisions that were made.

One of the main reasons for the pilot was to investigate the question of land "health". The technical team developed the protocols with this as a guiding principle, identifying quantitative and qualitative data elements could be correlated and analyzed. However, the exact correlations were not identified when the protocols were being developed. Had a list of desired correlations been available when the data elements and protocols were being developed, unneeded data may have been avoided.

Following are **highlights and keys points** of sections of the protocols.

Rural Transportation: Transportation routes whether developed or unimproved are important elements on the public lands and this element was added to the protocols.

Conservation Practices: The list of conservation practices was expanded to included items that may occur on public lands. Examples of new entries included burned areas, chained areas, and activity/management plans.

Land Cover: Many acres that BLM manages contain pinon and juniper trees. Additional codes were added to differentiate rangelands that have pinon and juniper and rangelands that have oakbrush from other rangelands.

Soils: The soils protocols were designed to identify the soils at the site, to verify them with soils survey mapping and descriptions, and to gather data that can be correlated with range health.

Soils - Quality: Immediately before the field season began, an additional procedure was incorporated into the pilot test. The procedure, developed by the Agricultural Research Service's (ARS) Jornada Experimental Range in Las Cruces, New Mexico, is designed to provide a measure of the aggregate stability and strength of the soils near the surface. Aggregate breakdown relates closely to infiltration and erodibility. If soil aggregates are instable during a rainfall event, decreased water infiltration results, due to partial blocking of pores with aggregate particles. Data for the procedure was collected from 16 points along the transect.

Because the procedure was introduced so late, the project manager decided to allow the test but only as time allowed (i.e., the original data collection protocol was priority and must be collected prior to conducting the aggregate stability test.)

Vegetation Production: The vegetation production protocol was selected to gather information to evaluate the similarity of a site to its potential natural community as described in a range or ecological site description. The method selected for gathering production data is commonly recognized and accepted by resource agencies, academia, and groups such as the Society for Range Management. The data was collected from ten plots along the transect. Plant species were identified and air-dry weight estimates made by species per acre on the site. This information was then used to calculate the similarity index, which determines "how similar" the site compares to the potential natural community.

Three different plot sizes were used depending on the type of species. A 9.6 square foot plot was used to record all herbaceous species (i.e., grasses and forbs). A 96 square foot plot was used to record shrubs less than 16 feet tall. If any trees or shrubs greater than 16 feet tall existed on the site, a .01 acre plot was used to record all shrubs and trees.

Vegetative Cover: The cover protocol was designed to collect data along specified segments of two, 150' transects at each point utilizing a modified line-intercept method developed by the staff at the Jornada Experimental Range (ARS). The cover data was stratified and collected as 1) basal measurements and canopy cover of ground cover (litter, microbiotic crust, rock/gravel and vegetation by life form), and 2) the canopy cover above ground cover. Additionally, canopy cover by species was collected on a 100' segment of the transect to maintain consistency with how cover was previously collected on NRI points. There were several reasons emphasis was placed on collecting cover data for the pilot project:

- Cover is an important measure of the degree of site protection from accelerated erosion.
- Cover can be utilized with several predictive models to estimate potential erosion with different management strategies.
- Cover information can be used to validate a number of the attributes of rangeland health in addition to erosion/site stability.
- Cover, along with structure, is an important measure of the "health" of wildlife habitat.

The protocol for collecting cover data was changed twice. The first change was as a result of the decision not to use "Personal Data Assistants" for the inventory and unfortunately the new protocol was implemented during the field crew training session in June. The second change in protocol occurred a month later in response to feedback that the cover data collection by species was taking too long to complete. The protocol was changed to collect cover data by life form (grass, shrub, forb, tree, and succulent).

Trees: The vegetation production and cover protocols included tree species in the measurements but they did not provide enough information to describe the condition of a forest or woodland. It was decided for the test to not attempt a comprehensive set of forest inventory measurements. However, minimal procedures were included to describe tree density, height structure, and insect and disease presence. Trees were counted on the .01 acre production plots. They were recorded by species and height class. The presence of insects or disease on individual trees was also recorded.

Rangeland Health: This qualitative assessment was incorporated into the protocols to evaluate the current function of ecological processes on a site. The assessment, which was developed by an interagency group of rangeland specialists, ecologists, and soils scientists, evaluates 17 ecological attributes. The assessment compares how ecological processes (i.e., water cycling and hydrology, nutrient cycling, energy flow, and recovery mechanisms) are functioning on a site compared to how the ecological processes functioned on the site under the historic climax community.

It was assumed that most of the information concerning the historic climax community is found in rangeland ecological site descriptions. However, the technical team acknowledged that many of the site descriptions are outdated and needed to be supplemented by reference areas and professional knowledge and insight.

Other data: Protocols were also developed to gather data on special status plants, noxious and invasive weeds, plant height by species, and the canopy of woody species.

G. Selection of the Sample

The sample sites used for this pilot were selected from existing NRI sample sites. The NRI sample is a stratified two-stage, unequal-probability sample that can be modified for specific survey objectives and used as a frame for special studies. Stratification was developed county-by-county, utilizing the grid of sections and townships defined by the Public Land Survey (PLS) system; each township was subdivided into three, 2-mile by 6-mile strata. Two-stage area samples were selected within each stratum. The first-stage unit, or primary sampling unit (PSU), was a quarter-section; at the second stage of sampling, three points were typically selected within each sample PSU. Sampling rates are typically between 2% and 6%, but rates used in remote areas are often 1% or less. There are many variations of this basic sampling scheme across the country and further details further details are available from NRCS and the Iowa State University Statistical Laboratory." The national NRI sample currently consists of 800,000 PSUs and 800,000 sample points.

The subsample of NRI sites used for the pilot was selected in several steps. First, the BLM Colorado State Office used GIS to determine which of the NRI sample sites fall on BLM managed lands. Then a sub-sample of these sites was selected county-by-county, within the BLM Districts. There was an attempt to make the sampling intensity as uniform as possible within each District. First, there was a subsampling of PSUs within each county; all PSUs within the county that had the same first-stage sampling rate were collapsed into one "universe", and the subsample of PSUs for the county was selected one universe at a time. If the PSU contained only one or two points falling on BLM land, they were all selected; if there were three points, only two were selected for the pilot. This sample contained 300 PSUs and 600 sample points within 34 different counties. The sample size for the pilot was later reduced to 222 PSUs in 16 counties. This reduction in sample size was not uniform across all counties; all PSUs were removed in 18 eastern slope and intermountain counties.

The sample size and sub-sampling design were developed to meet the originally established goals of the study, within certain constraints. Original goals included: a) obtain sufficient data so that statisticians can provide BLM with various alternative sampling scenarios at alternative reliability levels, b) determine what it would take for BLM to conduct an ongoing NRI-type program, and c) provide some general District-level information on resource conditions for BLM-managed lands. Constraints included lack of available staff for data collection as well as for managing the project, allocated budgets, and time constraints based on appropriate field season and anticipated completion date. The result of the reduction in sample size is that general resource conditions can not be compiled for all BLM lands in Colorado and derivation of alternative sampling schemes will be less specific.

The PSUs and points were provided to BLM on February 21, 1997.

H. Washington Office Briefing

On February 7, 1997, the project manager and the Colorado NRCS pilot project liaison met with officials from each agency in Washington D.C., to:

* update the Washington office managers and staff on the status of the pilot project,
* share information,
* raise issues and concerns,

* resolve issues, and
* allow the managers an opportunity to make decisions and provide additional direction.

The project manager presented the time line, workload analysis, staffing status, and issues and concerns. The Colorado NRCS liaison raised issues and concerns about the project. Decisions were made on the selection of a NRCS Washington office coordinator and on the sample number. Decisions were deferred on the following: possible soils assistance from NRCS, a final, formal decision on the recommendations, commitment to the time line, the interagency agreement, and the final selection of the points.

I. Desired Products

A list of desired products was developed and subsequently modified. See Appendix E.

The NRI has the flexibility to display data for a variety of desired correlations. To meet the deadline for the draft report, there was insufficient time to analyze the data for all the sites that were sampled. Therefore, it was decided to analyze the data in one major land resource area (MLRA #34) and come to some conclusions about the utility of the system. See Section IV.B.

J. Preparing for Data Collection

Numerous details needed to be completed prior to field data collection.

* *Selection and hiring of crews* and *procuring equipment* took a significant amount of time. (discussed in Section III.A.)

* The *protocols* that were developed had not been *field tested*. Therefore, the technical team met April 7-11, 1997, in Grand Junction, Colorado to: 1) field test the protocols at several different soils and range sites, 2) resolve any differences and issues regarding the data elements and protocols, and 3) develop the training strategy for the field crews. The technical team tested the protocols at three different range sites in the Grand Junction area. It was evident that the data collection procedures, while well-thought out, would likely require further refinement. Furthermore, the soil quality testing procedures were not yet fully developed and would not be until the field crews began work.

* A *handbook* was developed to provide data collection guidance to the field crews and to serve as a communication/information tool to provide to interested parties. Subsequent versions of the handbook were produced as the data collection process evolved.

K. Data Collection (May - October)

The field crews began on May 12, 1997. The first two weeks were devoted to training the crews. The first week of training (May 12-16) was held at the BLM Colorado State Office in Denver and focused on administrative procedures, safety, use of the GPS units, project overview, and data collection procedures. The second week of training (May 19-23) provided "hands on" experience for the field crews at different range/ecological sites. Area office field contacts as well as other agency staff attended the first part of this week and were provided an orientation to the project and the data collection procedures.

The field crews began collecting data on May 27. Not surprisingly, the going was very slow for the crews - it was requiring nearly six (6) hours to collect data on just one point. This was due to several factors - crew inexperience with data collection procedures, cumbersome and time-consuming protocols, unfamiliarity with local resources and access, and unfamiliarity with local office staff and operating procedures. In addition, because the protocols were new, consistent guidance and instructions on the part of the technical team was a problem. The time it took to collect data improved as crews 1) became more familiar with local conditions, resources and protocols, 2) as they became more efficient with logistics, and 3) as time-saving modifications were made to the protocols . By the first part of July, the decision was made to not make any more changes in the protocols for the rest of the field season.

During the first month, the crews were asked to participate in a weekly conference call (generally on Monday) to report to the project manager and technical team the progress and findings regarding data collection. Based on the feedback from the crews, adjustments were made to improve the protocols and procedures. During the first month, members of the technical team visited the crews to answer questions and provide guidance. The crews used the cellular phones to contact various technical team members when they had questions.

Because data collection was so slow the first month, it was soon evident that the original sample size for the pilot project was unrealistic. The target number was subsequently modified at a meeting held July 28-29,1997 at Iowa State University.

The crews were continually frustrated as they struggled to complete all of the inventory without compromising safety and quality. Early in the field season they struggled with new procedures and changing protocols. Later they had to contend with increased travel times and unfamiliar landscape types. In spite of the aforementioned adversity, the crews completed most of the PSUs in the revised target by October 1997.

A close out session was held with the crews, the technical team, and Washington Office staff on October 9-10, 1997. The purpose of the session was to have the crews provide feedback and evaluation on their field collection experiences and to allow for information sharing among the participants. The results of the session have been incorporated to applicable sections of this report.

L. Data Submission and Input

The collected data was submitted to Iowa State University's stat lab for data input. This task was difficult and cumbersome because data had to be recorded on paper forms. (The original plan was to have electronic personal data assistants (PDA) for data collection). Furthermore, because the protocols changed throughout the summer, data was recorded on several generations of paper forms. To assure that ISU received uniform forms for data input, temporary employees from an employment agency in Denver were hired beginning in August 1997 to assist in data cleanup.

During the closeout, it became evident that some problems existed with the data. It was discovered that often the range/ecological site description selected for a given point did not correspond with the soils that were described for the site. Therefore, some members of the crews were retained for several more weeks to review all of the sheets and rectify this problem and to fill in data gaps. Local staff from NRCS and BLM were enlisted to assist in this effort. After the field crews completed a review of the forms, an additional review of the data was conducted by some members of the technical team and other specialists from BLM and NRCS.

Once the data forms were submitted to the statistical lab at ISU, the staff followed a detailed process to enter the data. First, the forms were subjected to a pre-data edit. Obvious omissions or errors were corrected generally by phone with Colorado BLM. The data was then keypunched and verified (i.e., keypunched a second time). Finally, a series of edits were performed and any problems were coordinated and corrected with Colorado BLM.

Data entry by ISU progressed at a slow rate, due primarily to the cumbersome process that had to be followed with paper forms. It became evident in December 1997 that a change in the original plan to analyze all of the data needed to be changed if the March 31, 1998, deadline for the preliminary report was to be met. So, in order that some conclusions about the data may be made and incorporated into the draft report, a decision was made to initially concentrate on data that was collected in one major land resource area (MLRA). The decision was made to analyze data that was collected in MLRA #34 - Central Desertic Basins, Plateaus, Foothills, and Mountains. This MLRA encompasses land in west-central and northwest Colorado and extends into Wyoming and Utah. Public land comprises approximately 3,209,000 acres of MLRA #34 in Colorado. Data on approximately 103 PSUs in MLRA #34 were collected for the pilot project.

III. Results and Findings - Operational

A. Staffing

Staffing the field crews proved to be very difficult and exhaustive due to three primary factors. First, insufficient time was allotted for seeking and obtaining qualified staff. Second, soil science expertise within BLM is a very scarce skill. Third, qualified permanent staff within BLM were already burdened with other high priority work. Colorado BLM management therefore was reluctant to divert qualified permanent staff from other priority work to this project.

Given these constraints, several staffing options were pursued:

- * permanent BLM staff throughout the agency (if other high priority work would not be impacted),
- * retired annuitants,

- seasonal employment through vacancy announcements,
- specialists from other agencies (such as the U.S. Forest Service that may not be fully funded due to budget shortages),
- contracts with the Environmental Careers Organization (ECO) or similiar organizations to hire suitable specialists.

The option of contracting the work was also investigated. However, this option was discounted due to the following:

- uncertainty of what the contractors bid would be and if there was sufficient budget to cover the government cost estimate,
- requirements that contractors are forbidden to acquire or use the PLGR GPS units required to complete the inventory,
- insufficient time to complete a contract in time for the field season, and
- unproven and untested protocols that would likely be modified.

The following is a **summary by position** of how the crews were staffed:

Soil Scientists: In early March 1997 the NRCS agreed to provide and fund the salaries of two soils scientists to the project. The Colorado State Office of NRCS issued an interest announcement in March seeking candidates to serve on two of the four crews. Two soils scientists from Nebraska were selected. Each individual had more than 15 years of professional experience but neither had work experience in Colorado.

Several options were investigated to fill the other two soil science positions. An interest announcement was disseminated within BLM looking for possible candidates to serve on the crews. Several individuals expressed interest in a detail but none accepted due to other work and personal committments. Several other inquiries for possible soil scientist candidates to serve on the crews were made informally through the network of soils scientists within and outside BLM. An experienced soil scientist working for the USFS expressed interest to work on the crew duty- stationed in Montrose where he had previously worked for BLM under a temporary appointment. To ease budget difficulties, the USFS was receptive to the idea and an agreement between BLM and the USFS was made to provide for the detail. The soil scientist for the fourth crew was obtained by entering into an assistance agreement with the Environmental Careers Organization (ECO). This agreement is tiered to a national agreement that BLM has with ECO, a non-profit, educational organization whose primary goal is to provide training and work experience in resource management for associates who have received or are persuing a college degree. The associate hired for the project recently received a degree in soil science from a California university but had very little field experience. For the first month, the associate was tutored and trained by the USFS soil scientist in Montrose.

Range Conservationists/ Resource Technician: Initially, BLM offices throughout BLM were canvassed to determine the availability of any staff with skills in vegetation inventory to work on the crews. Unfortunately, specialists with appropriate skills to conduct the inventory were already burdened with other high priority workload assignments. Although it was late in the hiring season, it was decided to recruit for the positions from a vacancy announcement. The announcement was tailored to recruit a list of candidates for the following positions:

- an experienced *vegetation monitoring specialist* (GS-8 or 9) to provide leadership in gathering vegetationion data and rangeland health determinations.
- a *resource technician* (GS-5) to assist in all phases of data collection.

The CSO personnel office compiled a list of qualified candidates for each grade (GS-5 through GS-9) from the applications. The number of qualified candidates by grade were: GS-5: 34; GS-6: 4; GS-7: 7, GS-8: 1; GS-9: 5. Given the relatively large number of applications received, the project manager was confident that filling the positions was not going to be a major problem - he was mistaken.

The candidates were ranked according to the knowledge, skills, and abilities noted in the vacancy announcement and position descriptions. A standardized set of questions was developed for use during the interview process. Only five candidates qualified for the experienced vegetation monitoring specialist (GS 8 or 9). Although most of these applicants were very well-qualified, only two were hired from the list because some of the candidates received permanent job offers or opted for other temporary employment. Several other options were investigated: retired annuitents, utilizing existing inventory crews that has been doing similiar work with the USFS, and utilizing specialists from other agencies that may not be fully funded due to agency budget shortages. Fortunately, the USFS agreed to detail to the project an experienced ecologist stationed in Gunnison, one of the targeted duty stations. Unfortunately, a fourth experienced vegetation specialist was not obtained before the field season began in May. Therefore, the field season began with only three crews while the search continued for other candidates to staff a fourth crew. The USFS agreed to detail a range conservationist from Douglas, Arizona. He began working in mid-June with the Montrose crew and was subsequently relocated to Craig, Colorado on July 7, 1997.

Because 34 applicants qualified for the GS-5 position, filling these positions was not anticipated to be difficult. However it was difficult for several reasons:

- * Many of the applicants did not have the desired education and/or experience.
- * The interview process became quite lengthy and several applicants felt they could not wait until the interview process was over; they accepted employment elsewhere.
- * Candidates were offered and accepted a position on the crews, but subsequently declined employment in lieu of other options.

As a result, the field season began with only one GS-5 resource technician. Hoping that there may there may be qualified graduates or students from Colorado State University looking for employment, the vacancy announcement was re-issued through the Job Service in Fort Collins, Colorado on May 16. The Job Service utilizes the Internet, and as a result, several qualified candidates applied.. Two GS-5 range technicians were hired to fill the positions on the Montrose and Craig crews and they began work on June 16. Initially, the Gunnison crew felt that they could conduct the inventory with two persons (i.e. soil scientist and vegetation specialist.) However, after about one month the crew requested that a resource technician be hired to help complete the inventory in a timely manner. Therefore, a vacancy announcment was advertised through the Gunnison Job Service in June and a resource technician was hired and assigned to the Gunnison crew in July.

Volunteers: Several volunteers were used in the process. Two high school interns were used to assist in map preparation and post-inventory work. A volunteer that works with the soil scientist at BLM's National Applied Resource Service Center (NARSC) in Denver assisted in numerous aspects of the project from gathering ancillary data to organizing data samples for processing at soils labs. One crew utilized volunteers to carry equipment and assist in data collection.

B. Equipment and Supplies

A project code ("NRII") was approved in February 1997 to track both labor and other expenses. The project code was sufficient for identifying broad categories of equipment and supplies. However, tracking more specific expenditures was difficult. The "I" portion of the code was often confused with the number "1" that resulted in some miscoding.

Precise Location Global Positioning Systems Receiver (PLGR): This was the most critical equipment item. Due to national security considerations, the process for securing PLGR units within BLM is very labored and requires significant lead time. First, all requisitions must be submitted through a national coordinator who is currently located in Wyoming. Second, the national coordinator has a limited amount of "windows" when requisitions may be submitted. Third, approval to purchase PLGRs must be made by a board of approval within the Department of Defense. Requisitions for eight (8) PLGRS (two for each crew) were submitted to the national coordinator in February 18, 1997 in order to meet the March "window". The units didn't arrive until the last week of May. As a result, PLGR units needed to be borrowed from Colorado NRCS for the training sessions.

Safety Equipment and Supplies: The top priority of this project was the safety of the crews. Colorado BLM's Safety Coordinator was responsible for acquiring supplies and equipment for the crews. Thankfully, most of the equipment was not needed.

Field Equipment/ Supplies - Start-up: Prior to purchasing equipment and supplies for the field season, offices were canvassed to determine what may be available. Most offices had no available equipment or supplies so most items were purchased. Several members of the technical team assisted the project manager in ordering and purchasing start-up equipment and supplies from vendors such as such as Ben Meadows, Forestry Suppliers, Gemplers, and Wal-Mart. The acquisition process was greatly aided by the use of a government VISA credit card. Problems encountered included some double-ordering, improper application of procurement procedures, and improper coding of project and object classes.

The crews complained about some of the items supplied to them. Most notable were the cameras (not sturdy enough) and backpacks (insufficient size and sturdiness). Several crew members indicated that much of the equipment was serviceable but that they would have preferred something different.

Field Equipment/Supplies - On-going : The crews felt that they had sufficient latitude to purchase needed supplies during the field season. VISA credit cards were issued to crew leaders on three of the four crews. (There was not sufficient time to approve a card for the Craig crew leader who began in mid-June.) Each crew became familiar with established procurement procedures of the field offices where they were duty-stationed. Use of both credit cards and imprest funds worked well. Some offices had blanket purchase agreements (BPAs) with local businesses which greatly facilitated procurement of needed supplies and equipment. Problems encountered include improper project and object class coding, inadequate data to identify details of the items purchased (important for this pilot project), and tardy submission of credit card statements to the project manager.

C. Ancillary and Support Data

Substantial support materials were needed to conduct the project. Using information and experiences from previous NRIs, the team assimilated many items in advance of field collection. Other materials were gathered as the need arose during the field season.

Field Handbook: The handbook was the single most important support item for it provided the "cookbook" to guide data collection. A member of the technical team with expertise in inventory methods coordinated the development of the manual. The protocols that the technical team developed served as the framework for the manual. Each data element was defined and the procedures for collecting the information were described. Supporting information to assist the crews were provided as appendices (e.g., noxious weed list, rangeland health descriptors). In addition, the manual provided instructions and guidance in locating PSU/points, maintaining logbooks, and quality control. A copy of the handbook's Table of Contents is found in Appendix F. Readers interested in obtaining a complete handbook should contact the NRI Project Manager in the BLM Colorado State Office.

The handbook was revised three times due to two primary factors. First, time was very short between the completion of the the protocols and the start of the field season. Consequently, there was insufficient time for adequate review and refinement. Second, most of the data elements and collection procedures were new and untested. When the protocols were applied and problems surfaced, modifications needed to be made which required changes in the handbook.

Maps: Producing field maps for the crews and for field office contacts was time consuming and labor intensive. Approximately 250 topographic maps (7 ½' planimetric) containing the sample PSUs and points were borrowed from NRCS and copies produced at the BLM Colorado State Office. The PSUs/points were manually highlighted on the maps. Major drawbacks of the maps were: 1) labels covered key features of the landscape and 2) the absence of color made certain landscape features such as trees impossible to discern. Crews often needed to supplement the copies with standard 7 ½' topographic maps. See Appendix G.

The original intent was to have Geographic Information Systems (GIS) specialists generate 7 ½' minute color topographic maps displaying the sample PSUs/points with latitude/longitude coordinates and land status. Unfortunately, these maps were not avialable for the first part of the field season due to delays in receiving the sample points and difficulties converting in the data from GRASS (Geographic Resources Analysis Support System) to ArcInfo GIS. Nevertheless, GIS staff from BLM's Colorado State Office and NARSC continued to develop a program to generate the maps. Generating each topographic map individually was too time-consumming and labor intensive. Therefore, specialists developed a program and system to automate production of the 7 ½' topographic maps. First, the data needed to be properly configured using UTM (Universal Transverse Mercator) and latitude/longitude. Second, a program in Arc Macro Language (AML) was developed using the following steps:

1. Extract the NRI vector data (i.e. points, lines, etc.),
2. Combine the vector data with Digital Raster Graphics (DRG) data in image format,
3. Program the information into a map composition file, and
4. Send the file to the plotter.

Development of the AML program required substantial upfront work . Had the sample been provided two months earlier, all of the GIS 7 ½' topographic maps could have been produced.

Crews that were able to use the GIS topographic maps found them extremely helpful especially for logistics and determining ownership. All of the crews felt that the maps were a big improvement over the copied maps. These maps were also useful tools to explain the PSU/point concept. See Appendix G.

Specialists used ArcView GIS technology to create a 1:500,000 state-wide map that displays the location of 7 ½' topographic map boundaries (with names), PSU/points, land status, BLM district boundaries, and county boundaries. This map was useful for briefings, presentations, and training. It was also valuable for pre-work by serving as a handy reference for sorting maps for the files. In addition, a similiar map was created depicting Major Land Resource Areas (MLRA.) See Appendix G.

ArcInfo AML GIS systems were also used to create 1:100,000 quad maps depicting the PSUs/points, land status, and transportation systems. These maps were useful for logistics ans as information/education tools for briefings and presentations.

A reference sheet depicting each PSU point in the sample with corresponding township and range coordinates: This list was generated by GIS using data obtained from the NRCS data base. The crews needed this for programming a point's coordinates into the PLGR.

A reference sheet depicting each PSU point with the corresponding Major Land Resource Area (MLRA): This list was generated from GIS by intersecting the PSU/points theme with the MLRA data theme. The crews used this data to populate portions of the data collection form. A potential problem arose when it was discovered that Iowa State University (ISU) and BLM data differed because different sources were used.

Plant Lists: This list provided consistent plant codes on the data forms. Although it did not guarantee that every code submitted was correct, it provided one definitive source for data input and editing. The Colorado list was obtained from the data base maintained by NRCS in Fort Collins, Colorado.

Land Use History; Livestock (current use, historical use): This information was provided by the Resource Area Contacts (BLM/NRCS.) The degree of support varied by office. This information is very helpful especially if field crews are not thoroughly familiar with the area.

List of Noxious Weeds: This was provided by the BLM State Weed Coordinator and incorporated into the handbook. A color-illustrated handbook of Colorado's noxious weeds was provided to the crews.

List of Threatened and Endangered (T&E) Species: This table was provided by the BLM Colorado State Office T&E Coordinator and incorporated into the handbook. The handbook entitled, "Colorado Rare Plant Guide", prepared by the Colorado Rare Plant Technical Committee was also provided to the crews.

Landowners and Rancher Coordination: This task was completed by Resource Area Contacts, staff from BLM, and the crews. The degree field office of support varied. Some offices actively assisted in making contacts with landowners; other offices provided only names and crews had to spend pre-work time making contacts.

Range Site List/# : This was provided by NRCS members on the technical team.

Compilation of Range/Ecological Site Descriptions: This was provided by NRCS members on the technical team. If local adjustments had been made, they were supplied by local BLM and NRCS staff. Much of the data that was collected and analyzed depended on range or ecological site descriptions.

Wetland Cowardin System Pub. FWS-Obs-79-31, December 1979: This was provided by a NRCS technical team member and incorporated into the handbook. This information is required by the regular NRI conducted by NRCS.

National Soil Handbook Sec.603, 8000 Series Code: This was provided by a NRCS technical team member. Many items were extracted and put in the handbook.

Check List : This was developed by the Project Manager and included as part of the case file. It was designed to guide the crews through the steps of data collection and record the time it took to complete the various tasks. Some crews were confused on how to record time for certain tasks.

Soil Map with Soil Description/Soil Survey/ Hydric Soils List: This was provided by the BLM Colorado State Office soil scientist. As a service to the crews, each PSU file folder contained a copy of the appropriate soil survey with the highlighted PSU and potential soils descriptions. This amounted to an enormous work load. Most of the data was obtained from the Internet although some needed to be retrieved from NRCS field offices.

Plant Books/Field Guides: These were provided by BLM. Some crew members opted to use their own guide. Crew differed on their preference of field guides.

Aerial Photos with Index: This was provided by BLM Colorado State Office staff. This resource proved very valuable to plot access, determine accessiblity, identify changes in land types, and determine landscape features within a PSUs. The aerial photo coverage in the state varies and an inventory of coverage available along with flight lines needed to be conducted. The maps needed to be gathered from a variety of sources and included in the PSU files.

Land Ownership: The original intent was to include this information on 7 ½' topographic maps generated by GIS staff at the BLM Colorado State Office. Insufficient lead time prevented this from occurring. Therefore, a BLM Colorado State Office Realty Specialist researched each PSU with BLM color quad maps and master title plats to determine the ownership of each point. This information was included on an information sheet in each PSU file.

Access to the PSU: This information was provided by BLM Colorado State Office staff and Resource Area Contacts. Initial access information was provided by the Colorado State Office Realty Specialist using remote sensing tools and personal knowledge. Local offices supplimented this information. The degree of support from the field offices varied. Some offices simply responded to access questions from crew members while other offices provided interdisciplinary staff input and prepared maps that highlighted the best access routes.

Air Dry Weight Table: This was provided by an NRCS technical team member.

Production Tables- Juniper: This was provided by an NRCS technical team member. Many of the PSU contained pinon and juniper. This resource assisted in estimating vegetation production for these species.

Growth Curves: This was provided by a NRCS technical team member. Because the field season began in spring and ended in fall, this resouce assisted in estimating vegetation production.

Other Reference Books: Most staff used some of their own reference materials.

D. Training

Two weeks of formal training was given to the crews prior to data collection. The first week was held in Denver, Colorado and focused on safety, administrative/operational procedures, PLGR GPS training, and a classroom introduction to the field collection procedures. Crew members appreciated the emphasis placed on safety in the training and administrative procedures although several felt the training was too detailed. Several crew members felt that more detail on the protocols needed to be provided the first week. The second week of training was conducted in Grand Junction, Colorado and vicinity. The emphasis this week was to provide crews with actual field experience in collecting the data. Details of the two weeks of training is located on pages 6-8 of the Plan of Action (Appendix B.) Crew members felt that additional training was needed in plant identification and how to collect data in a variety of landscape types and terraine.

Much of the training the crews received was obtained on the job. Clearly, the first month was a learning experience for the crews as they struggled with unproven protocols, some of which were vaguely defined. The crew and technical team conversed weekly via conference calls to discuss findings. In addition, most members of the technical team went to the field with the crews to lend support and answer questions. The crew had to adjust to several changes to the protocols during the first month.

E. Administrative Support

The majority of administrative support for the crews was provided by the BLM Colorado State Office. Support included employment agreements, procurement of equipment/supplies, property transfer, vehicle reports, travel authorizations, travel vouchers, time sheets, issuance of credit cards, credit card statement verification, and injury/incident reports. In spite of the fact that the servicing office was remote, the crews received adequate and responsive administrative support. This would not have been possible without swift communication aided by FAX machines, e-mail, cellular phones, and voice mail. Once the field season was underway, the project manager had to spend the majority his time tending to the administrative and logistical needs of the crews. The BLM resource area offices where the crews were located provided additional administrative support by purchasing or otherwise providing additional equipment/supplies and lending advise on procedures.

F. Work Schedules and Logistics

The crews were placed on a maxi-flex work schedule with basic ten-hour work days. This allowed the crews some flexibility in the hours they worked without compromising safety. This was important given some of the long travel times and difficult sites they encountered.

There was insufficient time to develop a detailed logistics strategy to guide efficient data collection. Except for general guidance and criteria provided by the project manager, crews plotted their own data collection strategy. Most of the crews were not familiar with the geographic areas they were collecting data in and had not worked variable landscapes that comprise BLM lands. Consequently, miscalulations regarding travel times and access needs were common, especially early in the field season. As the season progressed, crews became more familiar with the BLM landscapes and with appropriate agency and landowner contacts. Consequently, they became more efficient and effective in accessing sites. The logistical support by field office staff varied from adequate to very excellent. Some examples of very beneficial field office support include the following:

- Some resource area contacts or other staff contacted landowners and ranchers providing advance notification of the inventory. Often the landowners provided good insight and information regarding access.
- Some Resource Area Contacts arranged for additional staff to meet and collaborate on the best routes and methods to access a site. Often the means of transportation a crew used to navigate to a site (i.e walking, vehicle, all-terraine vehicle, helicopter) was as important as the route to the site.
- Some staff highlighted the preferred route on the 7 ½' topographic field maps. They also included additional information such as names and phone numbers of applicable landowners as well as combinations to locked gates.

A test of the use of a helicopter to collect data using all four crews was conducted the week of September 15. The criteria for selection of the PSUs that were used for the helicopter test were remoteness, inaccessibility, proximity to each other, and what was remaining to complete the sample for the entire test. The project manager worked closely with the crews, the pilot, and the helitack forman to carefully plan the logistics including detailed flight plans and helispots. Details were communicated to the crews in advance through teleconferencing and e-mail. The 1:100,000 quad maps and 7 ½' topographic maps generated by GIS (discussed in Section III.c.) were of great value in planning. Flexibility was built into the plan to account for weather and unexpected delays in collecting the data. Overall, the use of helicopters was successful. It did increase the cost per point by $279 to a total of $1114 per point. (See Section III.K.)

G. Data Collection - Prework

The time and labor needed for prework was underestimated. The project manager, members of the technical team, and other staff at the BLM Colorado State Office worked many extra hours to provide the needed resources for the crews. The sample points were not provided in a usable format until the first part of March; this only allowed two months to gather the maps, soils information, and other support materials. Clearly, twice that amount of time is needed to adequately prepare for a project of this magnitude. More time to study aerial photos was needed to avoid unnecessary trips to sites such as rock outcrops where soils and vegetation data are not collected. A discussion of ancillary data and other support items involved in prework is found in Section III.C. and logistical support is found in Section III.F.

The amount of time the crews needed for prework was also underestimated. Critical actions such as gathering forms, maintaining vehicles, contacting landowners, procuring needed equipment, and gathering missing information about a site needs to be accounted for when scheduling and planning work. The time indicated in the checklists/logs for pre-work varied widely among the crews. It appears the crews may have been confused how to record the pre-work times. However, one of the crews kept very detailed records and the following describes the pre-work tasks and typical completion times:

* Gather and review maps (7½' topographic, 1:100K maps): 10-15 minutes
  Most files had a map displaying the PSU (provided by the BLM Colorado State Office Staff) but additional maps were frequently needed to assist in locating and accessing the site.

* Review potential rangesite: 10-15 minutes
  Early in the field season, the crew did not spend much time at this. As they gained experience, this was often completed in the office and again upon arrival at a site.

* Review soils descriptions and gather needed information: 15-20 minutes
  The BLM Colorado State Office soils scientist extracted the map and potential soils descriptions and placed them in most of the PSU files which minimized the prework time. However, the crew needed time to review the information before visiting the site.

* Review access and plot access to the PSU/points: 15-20
  A site with complicated physical or legal access took 30 minutes or longer.

* Gather forms, pre-populate data if possible: 5-10 minutes
  Several data elements on the forms were populated from review of maps, aerial photos, and conversation with local staff.

* Program PLGR: 5 minutes
  Most often this task was completed in the vehicle while in route to the PSU.

* Gather equipment, prepare vehicle: 5-10 minutes
  Crews spent a few extra minutes on Monday preparing the vehicle for the week. Occassionally, the crew would need to spend additional time to purchase or otherwise procure equipment.

* Other factors (that affected pre-work times): (average 5 minutes)
  These did not occur on all site; examples include:
  - crews contacting permittees, landowners, etc.
  - vehicle problems.
  - soils data not included in the file.

H. Travel To/From Sites

The travel time to a PSU point often was significant for several reasons. The sheer distance to many of the sites required significant travel time. Most of the sites required off-highway travel on very rough roads. Frequently, a longer route was used because a shorter, more direct route that crossed private land could not be used. What appeared to be promising access frequently was thwarted because of unforseen physical barriers (e.g. canyon walls, washed-out roads.) Occassionally, a locked gate surprised a crew forcing them to backtrack and find a different route. Substantial hiking was required to get to and from many of the sites. Early in the summer when data collection was taking up to six hours, some PSU had to be visited two times requiring double the travel time. Occassionally, a particularly complex PSU required two trips to collect the data on both points.

To provide some indication about the driving and hiking times needed to get to the site, data was extracted from from file logs/checklists for PSUs in Montrose, Delta, Mesa, Rio Blanco and Moffat Counties. All of the crews had difficulty the first month becoming familiar with changing protocols and most PSUs had to be visited twice. Therefore, to provide representation of travel times, only data gathered after July 1 are included in this assessment. See Tables 1 and 2.

Table 1

VEHICLE TRAVEL TIMES TO AND WITHIN PRIMARY SAMPLING UNITS (PSUs) 1/

Travel Time Category (hours)	# of PSUs
0 to 0.5	3
>0.5 to 1.0	9
>1.0 to 1.5	12
>1.5 to 2.0	16
>2.0 to 2.5	10
>2.5 to 3.0	15
>3.0 to 3.5	8
>3.5 to 4.0	10
>4.0 to 4.5	2
> 4.5	11

The mean travel time by vehicle to the PSUs is 2.48 hours. 2/
The median travel time is 2.25 hours. 2/

1/ Data from file checklists and travel logs from 96 PSUs in Delta, Mesa, Moffat, and Rio Blanco Counties visited after July 1, 1998.
2/ Assuming the midpoint in each travel time category (e.g., the midpoint for the 0 - 0.5 category is .25).

Table 2

HIKING TIMES TO PRIMARY SAMPLING UNITS (PSUs)

Travel Time (hours)	# of PSUs
0 to 0.5	30
>0.5 to 1.0	20
>1.0 to 1.5	15
>1.5 to 2.0	19
>2.5 to 2.5	5
>2.5	7

The mean hiking time within PSUs is 1.09 hours. 2/
The median is .75 hours. 2/

1/ Data from file checklists and travel logs from 96 PSUs in Delta, Mesa, Moffat, and Rio Blanco Counties visited after July 1, 1998.

2/ Assuming the midpoint in each hiking time category (e.g., The midpoint for the 0 - 0.5 category is .25.)

Four wheel drive sport utility vehicles (SUVs) were provided to all crews. Initially, one of the crews had a smaller SUV. Although the smaller vehicle was adequate, the crew complained about problems with clearance and inadequate space to haul gear. About midway through the field season, the smaller SUV was replaced by a full-size vehicle. The larger SUVs were roomy enough for a three-person crew and the sizeable amount of gear. The vehicles were equipped with adequate safety gear (possibly too much.) Several of the vehicles lacked chains which should be a required item. None of the vehicles had a cage to separate the cargo area and the passenger compartment. Because the sample points were widely diverse, many miles were put on the vehicles. Creative scheduling for maintenance for the vehicles was vital to avoid any serious delays in data collection.

Significant hiking to many sites was required. Frequently, hiking was done across steep, unstable, and hazardous terraine. Several crews reported falling when unstable terraine gave way. Crews members found they needed sturdy, lightweight shoes and provisions for inclement weather. The crews also discovered "the lighter the better" when hauling gear. Several crew members complained the packs that they were provided were uncomfortable and inadequate to carry the gear.

The crew duty-stationed in Grand Junction were able to use three (3) all-terraine vehicles (ATVs) from the field office. The ATVs proved to be extremely effective for accessing the rugged canyon sites around Grand Junction. Prior to obtaining the ATVs, the crew often became frustrated when their access was thwarted because the SUVs could not negotiate the narrow winding roads that are common in that area. The crew took an additional day to be trained on the machines; however, all of the crew members felt that day was well spent because the ATVs made access to many sites much easier and efficient. Unfortunately, two of the vehicles were involved in a mishap that totaled one and slightly damaged the other. The cost to replace and repair these vehicles was $2500.

Two canoes were used to access a remote PSU near a slow-flowing segment of the Yampa River in northwest Colorado. This provided an effective and enjoyable mode of transportation. Rafts were considered an effective means to access other PSU points along other tributaries; however, logistical difficulties prevented this from occurring.

As the field season progressed and PSU points near a crew's duty station were completed, the crews were faced with longer distances and travel times to remaining sample points. To reduce travel time and increase effeciency, arrangements were made to provide accomodations closer to the points. Several means were used:

- * Most often, motels in nearby communities were rented.
- * Self-contained camp trailers obtained from field offices were transported by district staff (fire crew, maintenance workers, etc) to campgrounds in remote areas. In one situation, camp trailers were transported to a Colorado Division of Wildlife administrative facility in northwest Colorado. This required special logistical coordination.
- * Crews were allowed to stay at no cost in the administrative facilities at the Colorado Division of Wildlife Little Hills State Wildlife Area which contains beds, restrooms with showers, cooking facilities, and a television.
- * One crew utilized the USFS accommodations in Saguache at no cost.
- * Arrangements were made to have all crews stay for two weeks in furnished apartments owned and operated by the Northwest Colorado Community College in Rangely. During the summer most of the apartments are vacant and the college rents two and three bedroom apartments for $20 per apartment per day. This proved to be a very cost effective way to house all of the crews while in travel status. This also gave the crews an opportunity to coordinate and share experiences.

I. Data Collection at Sites

During the first month, data collection at the site required so much time that only one point was being visited per day. (The original estimate was two points per day). There were several factors why the data collection was taking so long. First, the crews were not familiar with the data elements and protocols. Second, many of the crew members needed time to become familiar with the soils, vegetation, and range sites they were dealing with. Third, determining weight estimates for vegetation took extra time. Fourth, the protocols were in a continual state of flux. As the crews applied the protocols, they relayed their findings to the technical team who subsequently made several changes to shorten the data collection time. The final collection procedures and forms were finalized by July 1. The final forms are found in Appendix H.

Near the end of field season, crews were approaching two points per day. Beginning July 1, the crews were authorized overtime in order that the second point could be completed. Generally, the soils data took less time to collect than the vegetation data. Once the vegetative cover procedures were modified to use life forms and not species, the soil scientist was able to effectively assist in the collection of vegetation data.

Several factors adversely impacted data collection. During June and the first portion of July, pinon gnats made collection miserable for crews at sites 5,000 to 8,500 feet in elevation. Some sites were on extremely steep sites with unstable footing which made walking along the transect very difficult and at times dangerous. Often, crews had to contend with adverse weather that caused delays. The paper forms were very difficult to manage and often needed to be recopied.

Data collection at the site is described by the following categories: set-up, soils (pit and soil quality), vegetation (i.e., cover, production, trees, plant height, weeds, T&E species), and rangeland health. Data from all of the PSU file logs and checklists were used to compute the time it took to complete the various tasks at the site by month and is displayed in Table 3.

Set-up: Set-up consisted of several tasks. Additional information was gathered for the PSU data pages 1-3 of the data collection forms. Ownership, use, wetlands, and conservation practices at the point were recorded on page 4. If the point was on rangeland or forest land, additional data was collected. If the point was on any other land type such as bare exposed rock, no additional data beyond page 4 was recorded.

If the point was determined to be rangeland or forest land, the transect tapes were put in place according to protocol along with pin flags and other location devices. See Appendix I. The most suitable range site description was selected for the production inventory and rangeland health assessment. Selection of the range site proved to be confusing and difficult for there was not a "good fit" for many sites.

A minimum of three photos were taken. See Appendix I.

If the tapes crossed into a contrasting soil that produced a different range /ecological site, the contrasting soil identification and verification was done at the extreme end of the range transect that extends into the contrasting unit. In addition, vegetation production data, cover data, and rangeland health data were recorded separately. Additional production plots were added to total ten for the primary site where the point was actually located. Appendix I contains the configuration of the transect where multiple sites were encountered.

Near the end of the field season, the amount of time needed to set up for collection decreased slightly as the crews discovered efficiencies. Some of the more densely vegetated sites required 45-60 minutes to set up due to difficulties in laying out the transect tape.

Soils-Pit: A soils pit was dug four meters from the point in the northeast quadrant of the transect. Occassionally, the soil scientist dug the pit in a different quadrant if the location in the northeast quadrant did not represent the soils (e.g., rock). Tests and observations from the pit were recorded on pages 6-8 of the data collection forms (Appendix H.) The crews frequently encountered soils that did not have a soils component name which required full classification and description.

Soils - Aggregate Stability: Shortly before the field season began, an additional procedure was incorporated into the pilot test. The procedure provided a measure of the aggregate stability and strength of the soils near the surface. Surface soil from 16 points along the tape were tested and data recorded on page 9 of the data collection forms (Appendix H.)

Because the procedure was introduced so late, the project manager decided to allow the test but only as time allowed (i.e., the original data collection protocol was priority and must be collected prior to conducting the aggregate stability test). When this test was performed it increased the time for the crew to collect data at the site by 20 - 45 minutes. This was due to the extra time that the soils scientist had to spend on the aggegate stability test which allowed less time to assist in tasks such collecting cover data.

Vegetation - Production: Early in the field season, the crews were confused on how to apply the production protocol when confronted with shrubs and trees. This problem eased as the field season progressed and the procedures were explained by the technical team. The crews had to spend a sizable amount of time early in the process defining and weighing species weight units. Occasionally, the crews conducted double sampling for quality control. However, double sampling was not conducted with the frequency prescribed in the plan. (See Section III. K). Some crew members questioned the value of collecting production data, especially for sites where the range site description was outdated. Often the "best fit" didn't fit very well.

Vegetation - Cover: Initially, the cover protocol caused some significant problems. The original protocol often required three more hours to complete because plant species had to be identified and recorded. The procedure was extremely tedious and could only be conducted by crew members that knew the plants. The crew relayed their findings to the technical team who determined that changes in the process needed to be made. The biggest time-saving change that was made was to record only life forms, not species. This procedure was much speedier and allowed crew members with little knowledge of plants to assist. The forms were also modified to be more user friendly.

Without Personal Data Assistants (PDAs), recordation was highly vulnerable to error. Furthermore, the format was difficult to check ones work. However, the crews felt the modifications were a major improvement and after June, the average collection time was less than one hour.

Rangeland Health: The rangeland health assessment took about 15 minutes to complete. Often the ecological site description did not provide the information needed for classifying the ecological attributes. The crews then needed to rely on professional judgement. Except for some assistance by local BLM and NRCS staff, the crews did not have the advantage of local insight into most areas.

Post-work: A sizeable amount of time was needed post-field work time. Because paper forms were used for data collection in lieu of the PDAs, the crews had to spend time reviewing the forms, filling data gaps and making corrections. This amounted to about one hour per PSU. For about one-half of the PSUs, an average of 10-15 minutes was needed to identify unknown plant species. Approximately 5-10 minutes per PSU was needed to identify and box soil samples for shipping for subsequent soils testing.

Table 3

Data Collection Times By Task at the Point (in Minutes) 1/

Task	July		August		Sept./Oct.		Notes
	Mean	Median	Mean	Median	Mean	Median	
Set-Up	27.26	25	29.84	25	23.80	20	The range is 10 to 85 minutes
Soils - Pit	61.45	60	53.55	60	59.88	60	The range is 25 to 120 minutes, data is collected concurrently with vegetation.
Soils - Quality	54.29	60	64.57	75	65.30	75	Only a relatively small number of sites collected; the range is 25 to 105 minutes
Vegetation Cover	68.22	60	58.99	50	54.82	45	The range is 20 to 170 minutes
Vegetation Production	78.31	75	76.52	70	73.21	65	The range is 20 to 150 minutes
Trees	15.83	15	14.07	15	18.54	15	The range is __ to ___minutes, often this data was collected concurrently with vegetation production
Rangeland Health	19.57	20	16.25	15	15.66	15	The range is 5 to 35 minutes

1/ Data from all file checklists and travel logs visited after July 1, 1998.

Total Time at the Site: Assuming that soils and vegetation data were collected concurrently, the average time at the site was approximately 2.8 hours. If soils quality data (i.e., aggregate stability) was not collected, the time at the site averaged about 2.4 hours. If the site was land cover other than rangeland or forest land and no further data recorded beyond Page 4 of the data collection forms, the average time at the site was 15 minutes.

Approximately 89% of the sites were visited and determined to be rangeland/forest sites , 6% were visited and determined to be other land cover, 3% were visited and determined to be other land cover, and 2% were sites not on BLM and not visited.

J. Quality Control

Whereas the quality control plan was good, the execution of several elements of the plan was poor. The amount of time needed to appropriately conduct quality control measures was not properly factored into the original sample size. However, the point was often made that the success of the project was contingent on completing all of the sites identified in the sample. Therefore, the project manager and the crews continually struggled throughout the summer to complete data collection while properly executing the measures outlined in the quality control plan. Simply stated, the sample size for this pilot test was too large to complete with appropriate quality control.

Following are more detailed observations on the execution of the various components of the quality control plan.

Item 1 - " For estimating the production of plant species using weight units and weight unit weights, the Double Sampling Method will be used by each NRI crew on the first point of the first day, each week."

Overall, the Double Sampling Method as prescribed in the handbook was not followed. Although crews rarely followed the exact double-sampling protocol, they conducted some form of calibration in various ways. One crew calibrated daily at the first plot of the first point by estimating, clipping, and comparing. Another crew calibrated about once per week by clipping and weighing but it wasn't always the first point of the first day, each week. Another crew clipped and weighed to establish weight units and recalibrated when there was an obvious change in the plant. That same crew clipped and weighed when venturing into different habitat types.

Item 2 - "One scheduled day each month, two NRI crews will meet on a PSU and sample the points using a flip flop method. The crews will be designated as Team A and Team B. While Team A is collecting data on Point 1 (identified as Pt. 1a data), Team B is collecting the data on Point 2 (identified as Pt. 2b data). Leaving the tapes and pins in place, the Teams then flip-flop so that Team A goes to Point 2 and collects data identified as Pt. 2a data, while Team B collects the data on Point 1 identified as Pt. 1b data. Thus, Team A completes data sheets 1a and 2a for all protocols, and Team B completes data sheets 1b and 2b for all protocols. All protocols include the Soils data (classification and verification, soil quality, samples, etc.), Production data, Cover data, Tree data (if appropriate), and Rangeland Health Assessment. The only protocol not duplicated is the photo's taken at each point. The Team (crew) that begins the first data collection on the point is responsible for taking the required photo at that point."

This technique was conducted only once. Because the crews were many miles apart, it was difficult to efficiently schedule this procedure. The one time it was conducted, the crews were brought together to work on points in the vicinity of Rangely.

Item 3 - "Members of the Technical Team will periodically accompany the crews to points within the PSU, observing and assisting crew members in collecting the data."

Early in the field season, several members of the technical team visited the teams to provide guidance and training. The crews were very grateful for the support and welcomed the assistance. Overall the technical team support was quite successful although inconsistent guidance from different technical team members did create some confusion. Had there been more time for the technical team to test and refine the protocols, much of the confusion would have been eliminated. Field visits from the technical team declined after June due in part to a misunderstanding between the project manager and members of the team. Because of the confusion that was occurring because of conflicting guidance, in July the project manager instructed the technical team to let the crews operate on their own for a while. Unfortunately, this was misinterpreted by several members of the team to mean that the technical team should no longer make field visits. As the field season progressed, the project manager was busy tending to the operational, logistical, and administrative needs of the crews and failed to properly re-integrate field visits by the technical team.

Item 4 - "To eliminate potential errors that could result from manual computation, the main frame computer will be programmed to do those computations."

Iowa State University (ISU) Statistical Lab programmed the computer to do certain mathematical computations to eliminate errors and decrease post-work time by the crews. For example, the computer was programmed to calculate total weight in pounds per acre by vegetative species (column 14 of page 12 of the field collection forms). In addition, several manual and computer data edits were factored into the process.

Item 5 - "Prior to sending a copy of the field collection data forms to ISU for data entry, all forms will be reviewed for legibility, completeness, and accuracy. With the absence of PDAs, it is anticipated that main frame data runs will identify missed errors that can and will be corrected."

All crews reviewed their forms before submitting them to the Colorado State Office. Some crews were much more thorough in their review than other crews.

Beginning in August, two associates from a temporary workforce agency in Denver were hired to work on data review and cleanup. The associates reviewed the forms for completeness and legibility, identified data gaps, and recopied the data onto new forms when necessary. All of the data forms used in May and June required extensive editing and recopying because they were significantly different than the final forms. For forms completed in May and June, the associates converted the data collected for vegetation cover from species to life forms. This required significant oversight by the project manager and technical team members in the state office. After several forms were completed, the associates made copies and mailed them overnight to ISU. A coordinator at ISU then reviewed the forms. Most questions and problems were resolved over the phone. After October, one temporary associate was retained and worked until December 30, 1997.

During the field crew close-out meeting on October 9, 1997, it became evident that some potential problems existed with certain data elements. Most notable were concerns over the proper range/ecological site and soils identifiers. To address this concern, the project manager extended the appointments of four of the crew members to review the files, make corrections, and fill in data gaps. (This was be done in lieu of having a crew continue collecting data on four PSUs that were not completed.) The crew members coordinated with local NRCS staff to help identify the proper range site descriptions. In addition to the crew review, members of the technical team and other NRCS staff met several more times in October and November to review the files and conduct further "clean-up."

Item 6 - "To assist crew members with any questions that might arise while on site, cellular phones and radios have been provided so they can contact a member of the technical team for advise and clarification."

The radios were of little value to the crews to answer questions. However, the cellular phones proved very valuable. Numerous times, crew members were able to call various technical team members to get immediate answers to questions on data elements and protocols. One constraint was "roaming" charges by phone companies for having the phones powered on. Because of these charges, phones had to be turned off most of the time. Therefore, it was difficult at times for technical team members to return calls.

Other Quality Control Methods: The following are additional actions that were used to maintain quality. Early in the field season, three crews gathered near Montrose to collect data on two points. The crews "swapped" members and while collecting data, discussed procedures, methods, and general information. In early August, one crew member could not participate for one week. Therefore, two crews worked together and were able to share experiences, difficulties, ideas, methods, and resource information. Both crews discovered much similarity in how they were collecting the data. When all of the crews assembled in Rangely, the crews had numerous opportunities to coordinate and share experiences. All of the crews had an opportunity to work with each other on one PSU, affording them an opportunity to share resource information and discuss methods for data collection.

K. Budget vs Actual Costs

Table 4 provides cost data for conducting the pilot project. Most of the project costs were tracked with the use of a project code (i.e., NRII) which was approved in February 1997. For the most part, the project code worked well. Problems arose when the code was not used or when the object class was not used properly. (The object class is used to identify the item that was purchased). This necessitated a thorough investigation of all charges to determine which were associated with the NRI pilot project. Because many individuals in many offices were charging to the project, tight control of spending and proper financial accounting was difficult. However, rarely did any items get coded to the project without being approved by the project manager.

The BLM allocated $510,000 to the pilot project in Fiscal Year (FY) 97. Of that amount, $330,000 was provided to Colorado BLM. The BLM Washington Office retained the balance most of which was transferred to NRCS to meet the provisions of the national interagency agreement (IA). See Appendix A.

Precise accounting of all project costs is not possible because the technical team and other staff from NRCS and BLM were involved in various stages of the project but did not code their salary and other expenses to the project code. However, an estimate of their labor and expenses is included to better reflect total costs. These estimates are contained in Table 4.

The project would not have been completed without an enormous amount of donated and volunteer hours. An estimated 2070 hours with an estimated value of $42,300 were contributed by the project manager, technical team members (especially the soil scientists on the technical team), two BLM Colorado State Office interns (2), and volunteers (at NARSC and on of the field crews.)

The following provides some **additional information** into the costs:

Salaries and Other Labor Costs: The initial labor estimate for labor assumed that each of the crews would consist of a GS-11 Soil Scientist, a GS-9 Range Technician, and a GS-5 Range Technician. Actually, a variety of means were used to staff the crews. Two soil scientists from NRCS were detailed to the project through the national IA. Through several IAs between Colorado BLM and the USFS, a soil scientist (GS-12), an ecologist (GS-12), and a range conservationist (GS-11) were also detailed to the project. As part of the agreement, the BLM paid for approximately 75% of the salaries and the USFS paid 25%. The range conservationist did not join the crews until mid-June. Another soil scientist was hired to the project through an assistance agreement between BLM and the Environmental Careers Organization (ECO.) The amount paid to ECO equaled the employee salary (equivalent to a GS-7), payroll costs, and the fee ECO charges.

No overtime was anticipated but became necessary.

The cost of hiring temporary employees to assist in data clean-up was unforseen because it was assumed that Personal Data Assistants (PDAs) would be used.

Equipment and Supplies: Supplies needed for the safety of the crews was not given detailed consideration in the original estimates. Agency hand-held radios were utilized thereby decreasing costs. The cost of the batteries needed to keep the PLGRs operational was significantly greater than anticipated.

Travel Expenses: Total travel costs exceeded original estimates because four crew members were on full time travel status which was not anticipated. Significant travel-related savings by the crews accrued as they utilized trailers, they shared motel rooms when possible, and they utilized housing at reduced rates or at no cost (e.g., the community college apartments in Rangely and the Colorado Division of Wildlife facilities at the Little Hills State Wildlife Area.)

Vehicle Expenses: Original estimates for SUVs were based on the current General Services Administration (GSA) fee structure. Initially, GSA was not able to supply vehicles for the project. Therefore, vehicles owned by the Interior Department had to be used. The charges for the Interior were higher than GSA. In July, two GSA vehicles were deployed to the project. Therefore, from July to mid October, two Interior and two GSA vehicles were used by the crews. The GSA charged BLM a lower rate than original estimates because the vehicles were surplus.

Helicopter Support: Use of a helicopter to conduct field work would have been significantly more were it not for the following:

- The helicopter BLM used for fire was available and flight time costs were about one-half of normal commercial fees;
- Detailed logistical planning minimized flight time.

Table 4

Colorado National Resources Inventory Pilot Project
COST FIGURES (in dollars)

Cost Category	Original Estimate	Revised Estimate (6/6/97)	Actual Cost		Notes
			BLM	NRCS	
SALARIES/LABOR					
Salary and Labor - Crews under Temporary Appointments	175,000 a/	75,000	64,696 b/	-	a/ Estimate based on GS-11, GS-9, and GS-5 crew members with no overtime. b/ Total includes $5821 in overtime (306 hours), the 4th crew EOD - 6/16/97
Salary and Labor - Interagency Agreements and Assistance Agreements	a/	73,000 (BLM) 40,000 (NRCS)	80,264	43,897	
Salary - Project Manager	80,000	94,000	76,150	-	
Salary and Labor - Data Clean-Up	-	-	13,800	-	
TOTALS - Salaries/Labor	255,000	282,000	234,910	43,897	
EQUIPMENT/SUPPLIES					
PLGRS (GPS units)	16,000	17,000	16,728	-	
Equipment/Supplies - Start-Up	12,000 c/	9,000	9,004	-	c/ Original estimate was for all equipment/supplies

Table 4

Colorado National Resources Inventory Pilot Project
COST FIGURES (in dollars)

Cost Category	Original Estimate	Revised Estimate (6/6/97)	Actual Cost		Notes
			BLM	NRCS	
Equipment/Supplies - Safety	c/	1,000	1,746	-	
Radios and Cellular Phones	c/	1,000	387	-	
Equipment/Supplies - During Field Season	c/	7,000 d/	3,860	-	d/ Include estimates for cameras, film, and development.
Supplies for GIS, Aerial Photos	c/	1,000	152	-	
TOTALS - Equipment / Supplies	28,000	36,000	31,877	-	
TRAVEL					
Travel/Per Diem - Crews	36,000 e/	49,000	55,741 f/	-	e/ The original estimate didn't assume full-time travel status for some of the crew members f/ Of this amount, $23,831 went to NRCS crew members funded by BLM through National IA.
Travel/ Per Diem - Project Manager	10,000 g/	7,000	2,531	-	g/ Cost included some $ for equipment/supplies
Travel/Per Diem - Others	4,000	13,000 h/	3,323 I/		h/ Revised budget assumed that the CO NRI budget would bear much of the Tech. Team's travel costs; the majority of the technical team travel cost are shown under "Technical Team Expenses." I/ Includes $2669 for NRCS travel provided by BLM in National IA
Vehicle Expenses - SUVs	12,000	12,000	10,972	-	

Table 4

Colorado National Resources Inventory Pilot Project
COST FIGURES (in dollars)

Cost Category	Original Estimate	Revised Estimate (6/6/97)	Actual Cost		Notes
			BLM	NRCS	
Helicopter Expenses	10,000 l/	30,000	9,450	-	l/ Included both helicopter and other vehicle/logistical support
Other Vehicle/Logistical Support	l/	2,000	2,598	-	
Trailer Repair/Maintenance (for camping)	c/	3,000	3,413	-	
TOTALS - Travel	72,000	116,000	88,028	-	
OTHER EXPENSES - COLORADO BLM					
Miscellaneous	c/	10,000 j/	1,335 k/	-	j/ Because of so many unknown factors with the pilot project, a 3% continency was identified in the revised estimate. k/ Includes copy paper, business machine rental, Xerox paper, overnight mail, awards for crews
Analysis Costs Colorado		5,000 l/	-	-	l/ Revised estimate assumed some filed expenses such as software associated with the analysis.
Printing	2,000	2,000	500 m/	-	m/ The report was printed in-house
TOTALS - Other Expenses	2,000	17,000	1,835	-	
EXPENSES - W.O. BLM					
General Support	50,000	50,000	50,000	-	

Table 4

Colorado National Resources Inventory Pilot Project
COST FIGURES (in dollars)

Cost Category	Original Estimate	Revised Estimate (6/6/97)	Actual Cost		Notes
			BLM	NRCS	
Re-imbursable cost given to NRCS from BLM via National Interagency Agreement	150,000	130,00	101,100 n/	-	n/ The total re-imbursable amount in the National IA was $127,400 but $26,400 was accounted for in crew salaries and other travel; see Appendix ___ for details on re-imbursable cost to NRCS
TOTALS - W.O. BLM	200,000	180,000	151,000	-	
EXPENSES- NRCS					
As Identified in the National IA	-	285,800 o/	-	285,800 o/	o/ Estimate of the NRCS contribution to the project; actual cost unknown; see Appendix ___ for details on details on estimated NRCS contributions to the project.
TOTALS - NRCS		285,800	-	285,800 o/	
TECHNICAL TEAM EXPENSES					
Technical Team/ Salary	-	-	98,,850 p/	(37,100) p/	p/ Figure was calculated by adding the estimated time each member spent on the technical team (wm x average work month cost); the total # of wms by the technical team is 24; the amount for NRCS is contained in "Expenses - NRCS.
Technical Team/Travel	-	-	12,381 q/	(11,544) q/	q/ Figure was calculated using an average of $75 per diem rate and adding applicable commercial airline costs; the amount for NRCS is contained in "Expenses - NRCS.
TOTALs - Technical Team	-	-	111,231	(48,644) p/,q/	

Table 4

Colorado National Resources Inventory Pilot Project
COST FIGURES (in dollars)

Cost Category	Original Estimate	Revised Estimate (6/6/97)	Actual Cost		Notes
			BLM	NRCS	
OTHER CONTRIBUTIONS - LABOR					
Additional Support - Range Specialist Colorado State Office	-	-	16,500 r/	-	r/ Work included: gather ancillary data, procure equipment, provide briefings for staff/public, data clean-up (3 wms); from June 1996 through present.
Additional Support - Soil Scientist Colorado State Office	-	-	16,500 s/	-	s/ Work included: research/copy soils descriptions and maps for each PSU file; procure equipment, provide briefings for staff and publics, data clean-up (3 wms); from June 1996 through present.
Support - Realty Specialist - Colorado State Office	-	-	6,032 t/	-	t/ Work include gathering aerial photos, copying maps, researching land status/ access, etc., (1 wms).
TOTAL - Additional Support CSO	-	-	39,032	-	
TOTALS FOR THE PROJECT	557,000	916,000 u/	656,078	285,000 o/	u/ Includes estimates for BLM and NRCS

A. Protocols.

A final analysis of the protocols is not possible until data analysis is complete. The following narrative summarizes the findings to date.]

General: It appears that the plot designed cause no major problems especially as the crews gained more experience. Most of the data on roads and waterways was taken from topographic maps.

Soils - Pit: Many individuals associated with the project questioned the amount of data that was gathered at the pit. However, until the utility of the soils data is fully analyzed, it is premature to come to any conclusions about the data elements.

Soils - Aggregate Stability: Because this procedure was introduced so late, only about 20% of the sites were tested. However, the crew members and technical team were intrigued with the procedure although it appears to still be in the developmental stage. The potential to gather information to assess several components of rangeland health appears quite favorable.

Vegetation - Production: Early in the field season, the crews were confused on how to apply the production protocol when confronted with shrubs and trees. This problem eased as the field season progressed and the procedures were explained by the technical team. Some crew members questioned the value of collecting production data, especially for sites where the range site description was outdated. Often the "best fit" didn't fit very well.

Vegetation - Cover: The protocol for collecting cover data was changed twice during the course of this pilot project. The first change was as a result of the decision not to use "Personal Data Assistants" for the inventory and unfortunately the new protocol was implemented during the field crew training session in June. This led to some confusion and distracted the field crews from focusing on one cover data collection method.

The second change in protocol occurred a month later in response to a perception that the cover data collection by species was taking too long to complete. The protocol was changed to collect cover data by life form (grass, shrub, forb, tree, and succulent). This improved the efficiency of collecting cover information by:

* reducing the time it takes to collect data,
* reducing errors associated with plant identification and data compilation,
* improving the efficiency of the crew by allowing the soils specialist to assist the vegetation crew in collecting cover data since species identification was no longer required.

One problem associated with this change in protocol was the inability to compare species composition by weight and cover in the evaluation of the NRI protocol. However, if the production data is averaged by life form some of these comparisons can still be made.

Rangeland Health: The crews became comfortable with the assessment as the season progressed and they became more familiar with the landscapes and the rating attributes.

B. Data

Dr. Kenneth Spaeth, Rangeland Hydrology Specialist with NRCS (Northwest Watershed Research Center, Boise, Idaho), is providing leadership in the data analysis. The objective is to simultaneously evaluate plant community (plant species composition and various vegetation assemblages) and other inventory factors (environmental, range health factors, conservation practices etc.) A multi-variate analysis will summarize the 1997 NRI study and reveal trends and correlations in the data. The aim of the analysis is to discover the underlying order of existing vegetation and all factors attributing and affecting conditions and trends. The basic design of the Colorado NRI 1997 project will allow analysis at the MLRA level. The information will help identify resource strengths and weaknesses on public lands.

To meet the deadline for the preliminary draft report and still show what types of information and correlations are possible, a decision was made to concentrate the initial analysis on data that was collected in one Major Land Resource Area (MLRA). The MLRA selected was #34 - "Central Desertic Basins, Plateaus, Foothills, and Mountains." This MLRA boundary encompasses land in west-central and northwest Colorado and extends into Wyoming and Utah. Data on approximately 103 PSUs in MLRA were collected in the pilot test.

The initial phase of the analysis was designed to addressed the following:

* Summarize the state of MLRA 34, based on the 1997 inventory.
* Examine plant community composition and rangeland health attributes.
* Evaluate soil health with other environmental factors and plant composition.
* Evaluate watershed status and identify factors associated with watershed health.
* Calculate similarity indices for the respective NRI points and correlate with other factors.
* Identify and interpret plant-soil-environmental relationships on the MLRA level.
* Identify noxious weed problems and potential future noxious weed problems.
* Evaluate correlations between urban and build-up areas, roads, water developments, and streams with overall landscape conditions.

A total of 149 inventory points were sampled MLRA 34. The initial phase analysis addresses the 149 CRI points at several hierarchial levels. Appendix J displayes how the levels relate to each other.

1) Pooled Data Set . This is information on all 149 NRI points for MLRA-34, with accompanying range health data and environmental information.

2) Desert Region with range health data and environmental information. (The other two regions were not analyzed in this phase of the analysis.)

3) Vegetation Type 1 - the Juniper Upland Type with range health data and environmental information. (The other 5 vegetaton types are not analyzed in this phase of the analysis.)

4) Rangeland Ecological Site, Mountain Pinyon. The Mountain Pinyon ecological site is a component of the Juniper Upland Type with range health data and environmental information;

5) Rangeland Ecological Site, Clayey Saltdesert. The Clayey Saltdesert is a component of the Salt Desert Type.

Each of the five levels above contain relevant correlations for 1) ecological factors--individual plant species and environmental factors, and 2) environmental factors–environmental factors with other environmental factors.

1. Pooled data set for MLRA-34.

149 NRI points were sampled; 144 NRI points were used in the analysis.

The points in Figure 5 represent an ordination (ordering) of the 144 NRI points based on plant species composition by weight. Points close together represent similar NRI points with respect to plant composition. The further the points from each other, the more dissimilarity. The 144 NRI points represent all the rangeland ecological sites with the exception of the Blackbrush Mesa group (Appendix A - Group 20.) The Blackbrush Mesa site was omitted in this phase of the analysis because this site showed up as an extreme outlier in comparison with the other 37 rangeland ecological sites. The points in Figure 5 represent a considerable amount of variability in plant species compositon; therefore, robustness of the analysis is not as great as when sites are grouped (e.g., rangeland ecological sites 38, individual vegetation site groups 20, vegetation types 6, regions 3).

Environmental Correlations:

Active rills were correlated with active gullies, greater percentage of bare ground, soil surface instability (organic matter being lost from the surface layer), absence of planned grazing use, and steeper slope gradients.

Wind erosion was correlated with less distributed litter, minimal litter amounts, more active pedestalling, increased plant stress, reduced recruitment and reproduction of plants, and higher percentages of bare ground. With increases in elevation, there was a correlation of minimal evidence of wind erosion.

Ecological Correlations:

The similarity index was not significantly correlated with any of the 17 rangeland health attributes in the pooled data set.

More active rill formation, water flow patterns that are more numerous and less stable with deposition, and cut areas were associated with higher plant composition of Gambel's oak (QUGA), Utah juniper (JUOS), twoneedle pinyon (PIED), snowberry (SYOR), and cheatgrass (BRTE.)

Minimal evidence of rilling and stable water flow patterns were correlated with higher composition of western wheatgrass (PASM) and Wyoming big sagebrush (ARTRW8).

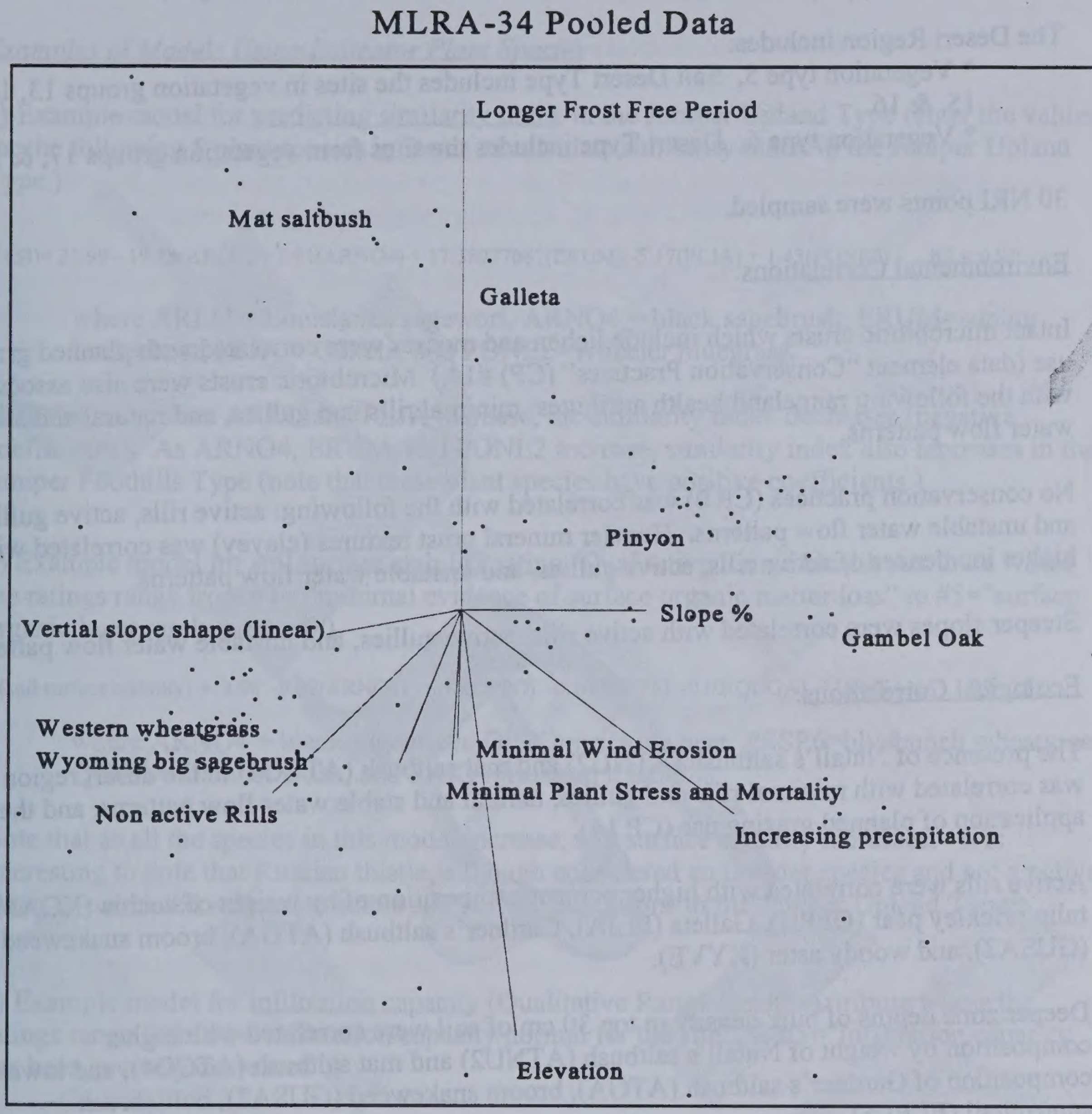

Figure 1. Ordination plot of 144 resource inventory points in MLRA-34. Arrows represent environmental gradients. If the individual arrows are extended in the opposite direction, the opposite exists e.g., If the non active rills vector is extended in the opposite direction, active rills are prominent.

2. Desert Region:

The Desert Region includes:

- * Vegetation type 5, Salt Desert Type includes the sites in vegetation groups 13, 14, 15, & 16.
- * Vegetation type 6, Desert Type includes the sites from vegetation groups 17, & 18.

30 NRI points were sampled.

Environmental Correlations:

Intact microbiotic crusts which include lichen and mosses were correlated with planned grazing use (data element "Conservation Practices" (CP) #14.) Microbiotic crusts were also associated with the following rangeland health attributes: minimal rills and gullies, and natural and stable water flow patterns.

No conservation practices (CP 0) was correlated with the following: active rills, active gullies, and unstable water flow patterns. Heavier mineral crust textures (clayey) was correlated with higher incidences of active rills, active gullies, and unstable water flow patterns.

Steeper slopes were correlated with active rills, active gullies, and unstable water flow patterns.

Ecological Correlations:

The presence of Nutall's saltbush (ATNU2) and mat saltbush (ATCO4) in the desert region was correlated with minimal rills and gullies, natural and stable water flow patterns, and the application of planned grazing use (CP 14).

Active rills were correlated with higher percent composition of by weight of kochia (KOAM), tulip prickley pear (OPPH), Galleta (PLJA), Gardner's saltbush (ATGA), broom snakeweed (GUSA2), and woody aster (XYVE).

Deeper zone depths of bulk density in top 30 cm of soil were correlated with higher composition by weight of Nutall's saltbush (ATNU2) and mat saltbush (ATCO4), and lower composition of Gardner's saltbush (ATGA), broom snakeweed (GUSA2), bottlebrush squirreltail (ELEL5).

3. Juniper Upland Type.

The Juniper Upland Type contains the following rangeland ecological sites: Foothills Juniper Mountain Pinyon, and Loamy Mesa Top PJ.

At this level of classification, models are presented for 1) the Juniper Upland Type utilizing plant species only (i.e., other environmental variables were not included) and 2) models using combinations of plant and environmental variables. The utility of this is that excellent models can be derived from plant species composition data which serve as indicator species for a variety of factors such as similarity index, soil surface stability rating, infiltration and runoff rating. These models can be developed at any level of classification or grouping. For demonstration purposes, models for the Foothills Juniper Type are displayed.

Examples of Models Using Indicator Plant Species

1) Example model for predicting similarity index in the Juniper Upland Type (enter the values for the following 5 plant species in lbs/ac to calculate similarity index in the Juniper Upland Type.)

Y (SI)= 31.99 - 19.88(ARLU) + 1.91(ARNO4) + 17.38977087(ERUM) -5.17(PLJA) + 1.43(PONE2) R2 = 0.91

where ARLU = Louisianna sagewort, ARNO4 = black sagebrush, ERUM=suphur buckwheat, PLJA = Galleta, and PONE2=Wheeler bluegrass.

Note that as species ARLU and PLJA increase, the similarity index decreases (negative coefficients). As ARNO4, ERUM, and PONE2 increase, similarity index also increases in the Juniper Foothills Type (note that these plant species have positive coefficients.)

2) Example model for soil surface stability rating (Qualitative Range Health Attribute where the ratings range from #1= "minimal evidence of surface organic matter loss" to #5="surface organic layer rarely present".)

Y(soil surface stability) = 3.98 -0.09(ARNO4) -6.78(OPPO) -0.16(PSSP6) -0.02(QUGA) -13.96(SAKA) R2=0.82

where ARNO4 = black sagebrush, OPPO=prickley pear, PSSP6=bluebunch wheatgrass, QUGA= Gambel's oak, and SAKA=Russian thistle.

Note that as all the species in this model increase, soil surface stability increases. It is interesting to note that Russian thistle, although considered an invader species and not a native plant, is correlated with more stable soil surface conditions in the Juniper Upland Type.

3) Example model for infiltration capacity (Qualitative Range Health Attribute where the ratings range from #1="infiltration capacity normal for the site", to #5="infiltration capacity has been severely decreased".)

Y (infil) = 2.71 -2.26(CRYPT) + 1.56(EREA) -2.16(ERIGE) + 0.07(GRSQ) -1.31(SYOR) R2=0.82

where CRYPT=cryptogams, EREA=Eaton's fleabane, ERIGE=erigena, GRSQ=curly cup gumweed, and SYOR=snowberry.

Note that as CRYPT, ERIGE, and SYOR increase, infiltration becomes more normalized in reference to the site. As EREA, and GRSQ increase, infiltration capacity is reduced.

4) Invasive plants example

Y (invasive plants) = 1.50 + .31(BRTE) + 17.09(CHENO) + 0.13(AMAL) + 5.39(ERIGE) + 0.057(MAGR2) R2= 0.8625

where BRTE=cheatgrass, CHENO=goosefoot chenopodium, AMAL=prostrate pigweed, ERIG=erigenia, and MAGR2=goldenweed rayless aster.

Note that as these plant species increase (lbs/ac), the degree of invasive plants increases.

Examples of All Possible Variables: Plant Species and Environmental Variables

1) Example model on infiltration capacity with all available variables.

Y (infil) = 0.34 + 0.038(CEMO2) + 0.0059(JUOS) + 3.18(YUGL) + 0.62(PEDEST)   R2= 0.88

where CEMO2 = mountain mahogany, JUOS = Utah juniper, YUGL = yucca, PEDEST = qualitative rangeland health attribute where the ratings range from #1 = "minimal current or past evidence of pedestalling" to # 5 = "active abundant pedestalling."

2) Example model for soil surface stability

Y(Soil Surf. Stab) = 3.21 -0.09(ARNO4) -0.25(ATCA2) -0.19(BDRK-TYPE) + 0.25(CRUST-TEXT) + 0.08(A - HORIZON) R2 = 0.96

where ARNO4 = black sagebrush, ATCA2 = fourwing saltbush, BDRK-TYPE = Bedrock type (sedimentary: 01=sandstone, 02=shale, 03=limestone, 04=conglomerate, 05=other); (igneous: 06=granite, 07=basalt, 08=rhyolite, 09=other); 10=metamorphic; CRUST-TEXT = 01=sandy, 02=loamy, 03=clayey; A-HORIZON=A Horizon thickness in inches.

Note that as ARNO4 and ATCA2 increases, soil surface stability increases. As BDRK-TYPE increases, i.e., from types 1 (sandstone) and 2 (shale) toward type 5 (other) and 6 (granite), soil surface stability is correlated with presently stable conditions with no current evidence of organic layer loss.

3) Example model for invader plants.

Y (invader plants) = 10.44 -0.0008(ELEV) + 0.62(GULLY) -1.03(pH) + 1.24(FPLTGRP) + 0.077905(TZ BULK DENSITY) R2=0.88

where ELEV=elevation in feet; GULLY= qualitative rangeland health attribute gully where the ratings range from #1 = "natural stable channels" to #5 = "present with active erosion"; FPLTGRP = qualitative rangeland health attribute ("functional plant group") where the ratings range from #1 = "functional plant groups closely match the historic plant climax" to #5 = "significant change in funtional plant group"; TZ BULK DENSITY = beginning (top) zone of maximum bulk density.

Note that as ELEV increases, there is a correlation that invader plants are not present on the site. As GULLY and FPLTGRP conditions worsen, so does the invader plants. Also, invader plant are more dominant on sites where the zone of maximum bulk density is shallower.

4. Mountain Pinyon (Ecological Site #s 048AY114CO, 048AY114CO)

Eight (8) NRI points were sampled.

Environmental Correlations:

Intact mineral crusts were correlated with minimal rills and gullies, and minimal evidence of surface organic layer loss (soil surface stability).

Minimal rills and gullies, and minimal evidence of surface organic layer loss (soil surface stability) were correlated with conservation practices, chaining and seeding (CP 2, CP 9).

Less steep slopes in the Mountain Pinyon ecological site was correlated with minimal rills and gullies, and minimal evidence of surface organic layer loss (soil surface stability).

Loamy crust particle size class was associated with minimal rills and gullies, and minimal evidence of surface organic layer loss (soil surface stability), and parent material kind-residuum.

Ecological Correlations:

The following plants species were associated with minimal rills and gullies, and minimal evidence of surface organic layer loss (soil surface stability), and parent material kind-residuum: Wyoming big sagebrush (ARTRW8), bottlebrush squirreltail (ELEL5), Sandberg bluegrass (POSE), crested wheatgrass (AGCR), black sagebrush (ARNO), Louisiana sagewort (ARLU), small spikerush (ELSM). There were also some weedy species that were associated with minimal rills and gullies, and minimal evidence of surface organic layer loss (soil surface stability), and parent material kind-residuum: cheatgrass (BRTE), broom snakeweed (GUSA2), and thisle (CIRSI). Greater abundances of all of the above plant species was associated with microbiotic crusts largely absent, occurring mostly in protected areas and microbiotic crusts found in protected areas only. Higher incidence of microbiotic crusts was associated with less pedestalling, and planned grazing use (CP 14). The occurrence of mircobiotic crusts was more associated with the backslope landscape position.

Invasive plants are correlated with water flow patterns that are more numerous than expected; plant mortality and/or decadence is in excess of what is expected for the site; plant functional groups are changed–dominant historical plant functional groups no longer exist, subdominant historic plants dominate the site, and perennial vegetation shows signs of short term stress. Organic matter is lower on sites where the above conditions exist.

5. Clayey Saltdesert (Ecological Site #034XY403CO)

Twelve (12) NRI points were sampled.

Environmental Correlations:

Higher incidence of gullies with higher precipitation range and clayey crust texture.

Lower incidence of gully formation with linear vertical slope shape.

Intact microbiotic crusts are correlated with planned grazing use.

Intact microbiotic crusts are correlated with less pedesalling and gullies.

Ecological Correlations:

Intact microbiotic crusts are associated with higher plant composition of Nuttall's saltbush (ATNU2), and mat saltbush (ATCO4) and less abundance of shadscale saltbush (ATCO) green rabbitbrush (CHVI8), Sandberg bluegrass (POSE), western wheatgrass (PASM), annual forbs (AAFF), bottlebrush squirreltail (ELEL5.)

Higher production is associated with higher cheatgrass occurrence.

Higher precipitation range associated with higher incidence of cheatgrass.

Higher correlation of invader plants with higher cheatgrass (BRTE) occurrence.

Lower incidence of pedestalling with higher occurrence of lichen and moss crusts and planned grazing use.

Lower incidence of gully formation with higher occurrence of lichen and moss crusts and planned grazing use.

Higher incidence of gullies with higher composition of annual forbs.

C. Desired Products - Were They Achieved?

Only preliminary data can be reported at this time. This section will be completed upon further review of the data. However, the preliminary results of the data indicate that the desired products identified in Appendix E as well as other products will be delivered.

D. Criteria and Data for Estimating Costs

Table 4 details the costs associated with the Colorado NRI pilot test. For several reasons, it is not prudent to take the total costs expended for the Colorado NRI pilot project and use it solely for estimating future costs. Some of the costs incurred in the pilot project were peculiar to conducting a state-wide pilot project. Some of the costs were one time start-up costs. However, an estimate of the cost to conduct an inventory can be constructed using information learned in the project together with ***the following assumptions***:

1. The total cost of the project is dependent on how many points are needed to achieve the desired reliability, which is yet to be determined. For this analysis, assume one crew will conduct the inventory for six years.

2. The inventory protocols are established and fully operational.

3. The NRI is coordinated by a Resource Specialist, responsible for inventory execution and completion. The estimated time needed for the NRI project supervisor is three months annually.

4. A person responsible for quality control is assigned to the inventory. The estimated time needed for quality control is two months annually.

5. A technical team of two individuals (GS-11 soil scientist, GS-11 vegetation specialist) familiar with the protocols provide verification of the crew's work. For, example one day per month (three travel days) during the field season, they would perform the "flip-flop" procedure with the crew and compare data. The total estimated time needed for this is 1½ work months annually.

6. A person is needed to assist with logistics and administrative duties. The estimated time needed for these duties is three months annually.

7. The field staff consists of a permanent Soil Scientist (GS-11), a permanent Ecologist / Range Specialist (GS-9) , and temporary appointment Resource Technician (GS-5). During the winter months, the two permanent staff work on gathering ancillary/support data, plan logistics, assist in preparing budgets, order equipment and supplies, conduct post work, prepare reports, etc. Permanent staff member are on board by at least October prior to a field season (April-September). The resource technician is hired and on board by April 1.

8. The total number of work hours for each crew in a month is 176 hours after factoring a 7% reduction for "down time" and including five (5) hours of overtime per crew member per week. No extensive leave is granted during the field season.

9. Data is collected on two points within a PSU.

10. During the field season, the crew averages 34.5 points per month (or 5.1 hours per point). This estimate is derived with the following assumptions:

- Eighty-five (85%) of the prework is conducted in advance of the field season.
- Improved logistics will decrease travel times (and costs) by 20%. The two permanent members on the team may be on full-time travel status during five of the six field seasons.
- The time required for field collection will decrease by 15% by streamlined protocols and efficiencies.
- The time needed for post-work decreases by 75% because PDAs are utilized.
- Full data will not be collected on all sites (based on experiences this past summer, approximately 89% of the sites were visited and determined to be rangeland/forest sites , 6% were visited and determined to be other land cover, 3% were not visited and determined to be other land cover, and 2% were sites not on BLM and not visited).

Table 5 details the elements used to calculate a unit cost per point to conduct NRI in the future.

Table 5

Calculation of Unit Cost to Conduct the NRI

Item	Annual Cost	Start-up Cost
Supplies/Equipment (inc. PLGRS, Cell Phones, Radios,Safety)- Start-up		8,000
GIS/Aerial Photos		5,000
Supplies - Field (inc. replacement of gear as needed)	1,700	
Salary - Project Supervision (GS 12/5 x 3 mo. x 1.17 benefits)	15,300	
Salary - Quality Control Oversight (GS 12/5 x 2 mo. x 1.17 for benefits)	10,200	
Salary - Tech Team (GS 12/5 x 1½ wm)	7,600	
Salary - Soil Scientist (GS 11/5 x 1.17 for benefits)	51,200	
Overtime - Soil Scientist ($31.50 x 5 hr/wk x 26 weeks)	4,100	
Salary - Ecologist (GS 11/5 x 1.17 for benefits)	51,200	
Overtime - Ecologist ($31.50 x 5 hr/wk x 26 weeks)	4,100	
Salary - Range Technician (GS 5/1 x 6 mo. x 1.0946 for benefits)	11,500	
Overtime - Range Technician ($14.50 x 5 hr/wk x 26 weeks)	1,900	
Travel and Per Diem Project Supervisor/QC	2,500	
Travel and Per Diem - Technical Team	3,400	
Travel and Per Diem (Crews)	9,200 (12,500)*	
Vehicle	3,000	
ATVs/Trailers (purchase)		15,000
Other Logistical (repairs,rental,etc)	1,500	
Miscellaneous	1,000	
TOTAL	**179,400(182,800)***	**33,000**

*** The travel and per diem cost may be higher if the soil scientist and ecologist must be on full time travel status.**

The cost per point is $893. This was derived as follows:

$179,400 annual cost
+ $ 5,500 start-up cost (annual cost if amortized over 6 years)
$184,900/year

$ 184,900/year ÷ 207 points/year = $893/point

If the permanent crew members must be in full-time travel status, the cost per point is $909. This was derived as follows

$182,700 annual cost if crew on full time travel status)
+ $ 5,500 start-up cost (annual cost if amortized over 6 years)
$188,200/year

$ 188,200/year ÷ 207 points/year = $909/point

E. Additional Benefits, Products, and Applications

The NRI pilot project provided and opportunity to collect in one place soil surveys that cover the public lands in Colorado.

Soil surveys throughout the state were that cover public lands in Colorado.

The photos taken at the points may provide future guides for lands that are healthy, at risk, or unhealthy.

The data collected will benefit the Southwest Satellite Imagery Project by providing ground truth data for specific locations.

The inventory confirmed that most of the the ecological site descriptions in Colorado are outdated and in need of revision. The data that was collected in the inventory will provide resouce information when the sites are updated: cover, updated productions and species composition, microbiotic crust, physical function, biotic integrity, and soils.

V. Recommendations

A. Lessons Learned from the Pilot Project

Interagency Agreement: Do not initiate a project that involves partners unless an Interagency Agreement is prepared and approved in advance.

Project Design and Scope: Do not attempt to complete the inventory for a state in one or even two years. Develop a strategy whereby the inventory for a state is completed over several years. Factor in sufficient time for prework. Each year the inventory should focus in a quadrant of the state where the crew may become familiar with the landscapes, soils, vegetation, and local area staff. Develop a plan of action early but build in flexibility. Allow sufficient time to review and modify.

Project Leadership: A NRI project should be led by an individual with proven project management skills. A person with technical knowledge and experience in soils, vegetation, and ecological interrelationships is preferred.

Technical Team: The technical team was and continues to be critical in the development of the NRI for public lands. Identify other key individuals from other agencies and academia as needed to assist the team in data analysis and protocol refinement. Work toward consensus which requires time to work through differences among team members. The size of the technical team will diminish as the protocols and methods become more fixed. However, a small core team of technical experts will always be needed to assist in quality control.

Resource Area Contacts: These individuals are a valuable whether the scope of the project is statewide or regional. They are especially useful if permanent staff are not used. Provide sufficient time to select the contacts for each office and then educate them on project objectives and their roles and responsibilities. A key to the success of the Resource Area Contact concept is the commitment resource area managers give to the project.

Base Inventory Structure: The basic inventory structure is sound and compatible with the NRI conducted by NRCS. Consider expanding the data collected on the PSU, particularly as enhanced aerial photography and other remote sensing techniques become available. Consider adding weed infestations and invasive plants as PSU data elements.

Investigate combining a detailed inventory similar to what was conducted this past summer with a broader inventory that relies primarily on remote sensing techniques. This may be a more cost effective means meet BLM's inventory requirements.

Personal Data Assistants (PDAs): Do not begin the inventory without properly programmed PDAs.

Staffing - Crews: Assuming the inventory data collection requirements remain similar, form a three-person crew consisting of *a soils scientist*, *an experienced vegetation specialist* (i.e. plant ecologist/botanist/range specialist), and *a resource technician*. Begin the recruitment process at least six months before the field season. The *soils scientist* should have field experience (preferably local.) The scientist should know how to use soils surveys, understand soils classifications, and understand the relationship between soil and vegetative site correlations. To maintain consistency in data collection, there should be some permanency to the position (e.g. permanent full-time position, permanent part-time position, long-term temporary appointment.) Because BLM has a limited number of soil scientists, consider a partnership with NRCS whereby NRCS would provide the soil scientist. The experienced *vegetation specialist* should have journeyman level experience in ecological processes, excellent plant identification skills, and a sound knowledge of local flora. To maintain consistency in data collection, there should be some permanency to the position (e.g., permanent full-time position, permanent part-time position, long-term temporary appointment.) The *resource technician* is particularly useful in organizing logistics, hauling equipment, and recording data (especially vegetation.) As the technician becomes more experienced, the crew becomes more efficient. The position is best suited for energetic college students majoring in ecology, botany, or range science. Other good candidates are those majoring in soil science with a background in botany or ecology.

Project Code: If tracking expenditures for NRI is important, establish a project code at the very outset of the project. If tracking expenses in more detail than in broad categories is desired, make certain anyone who uses the NRI project code knows the procedures.

Equipment/Supplies: Allow at least 8 months lead time for acquisition of the PLGR GPS units. Make sure that each crew has two (2) PLGRs. Plan on approximately $2100 per unit.

If scheduling allows, field crews should assist in identifying equipment and supplies. Allow sufficient time to canvass field offices for needed equipment and supplies on hand that can be used. Allow sufficient time to procure needed equipment. Keep the equipment as compact and light as possible without compromising safety needs. A security cage should be constructed behind the back seat of a sport utility vehicle to prevent movement of equipment and supplies to the passenger compartments in the event of a sudden stop or collision. One individual knowledgeable in procurement procedures should do the ordering, preferably with a VISA government credit card. All persons ordering equipment and supplies should be trained in the proper use of project and object class codes. If more detailed tracking information is desired, make sure that procedures are established and training provided to applicable staff.

At least one crew member should have a VISA government card for purchasing. Program enough time to obtain the card. Establish a budget for a crew to acquire goods and services and procedures for budget reporting. Establish procedures for tracking information and train all responsible staff. Utilize existing local blanket purchase agreements.

Ancillary and Support Data: Sufficient lead time is needed for proper refinement of the protocols so that a complete *handbook* may be produced. Sufficient time must be allotted to test protocols and to review and revise the handbook.

Maps are critical. Superior map products can be generated from GIS. From the pilot, many lessons concerning map development were learned and processes documented (especially for 7 ½' maps) that can be applied to future efforts. Sufficient time must be allotted to create and generate these maps. Adequate work space and storage should be provided for handling the maps.

Sufficient time must be provided to assimilate *aerial photos* for the sample. Inventory current aerial photo coverage. Budget for acquisition of needed photos. The training for the crews should include use of aerial photography and potential applications.

Enough pre-work time must be allotted to allow sufficient time for area staff (or crew members) to gather *local information* from case files and other data sources. Utilize local staff to identify ownership; use master title plats to determine public land boundaries. If necessary, research county records in the assessors office to identify private land owners and how to contact them.

The majority of the *ecological site descriptions* in Colorado need to be updated. Prior to embarking on a major inventory project that relies on range/ecological site descriptions, asses the quality of the descriptions and revise and update them as needed.

Sufficient time must be allotted for *logistics and access planning*. Specific directions must be provided to the field offices regarding their role in supplying logistics and access information.

If tracking of time is desired, design *a checklist* with clear instructions on how to record the time including increments.

Regarding *soils information*, provide each crew with applicable *Soil* Survey reports or Soil Survey manuscripts. The PSU files should contain the applicable soil map and accompanying soil map unit descriptions. From this information, the crews can determine the soil series description, classification, and other related soils information. Use the Internet to retrieve the soils series information. Provide the crew with the reference, "Classification of Soils Series of the United States."

Training: Allocate at least two weeks to teach the data collection procedures. The crews should be required to totally complete the protocol on several different ecological sites. Prior to embarking on an extensive field collection effort, the protocols must be firm and not subject to revision. The number of people at the training for the pilot project was somewhat overwhelming for the crews. Limit attendees at the training to the crew(s) and instructors.

Administrative Support: Develop a good tracking system for time sheets and travel vouchers. If many crews are used, a well-developed support system for administrative actions is crucial. Establish a project code early in the process. Channel all expenditures through the project manager or designee for tracking throughout the process. For a project the magnitude of the pilot project, hire or provide a detail for existing staff to be responsible for the administrative and operational portions of the project. This allows the project manager to concentrate on overall project management, including quality control.

Logistical Support: Allocate sufficient time to develop a detailed logistics plan. If feasible, involve the crews in the development of the plan. Local field office staffs need to be committed and involved in the logistics - from providing access information to contacting landowners. If the inventory is of similar magnitude to the pilot project, provide for an assistant to coordinate the logistics (possibly in conjunction with administrative duties.)

Prework: Field work should not begin until adequate prework is completed. For a project similar in magnitude to the pilot project (i.e. 300 PSUs / 600 points), allocate five (5) months for prework and provide an assistant (possibly in conjunction with administrative duties.) If a crew is comprised of permanent staff, use them to conduct most of the prework. Plan to spend more time studying aerial photos to minimize trips to sites where soils and vegetation data are not collected (e.g., rock outcrop.)

Travel To/From/Within Site: Provide a crew with a full-size, four-wheel drive sport utility vehicle equipped with aggressive mud and snow tires, chains, and a cage that separates the passenger and cargo compartments. If possible, the crew should have accessibility to all-terrain vehicles (three ATVs for a three-person crew) and be trained properly. Arrangements should be made with local field offices to utilize water vessels such as canoes and/or rafts as the need arises. Purchase sturdy, light-weight equipment and supplies to lessen the impact on crews when they must hike.

Travel time will always be a major cost in gathering data. However, a logistics plan with built-in flexibility will cut travel costs by as much as 20%. If the inventory is of similar magnitude to the pilot project, hire or otherwise provide for an assistant to coordinate the logistics (possibly in conjunction with administrative duties.) The use of a helicopter appears cost prohibitive unless it can be utilized at little or no cost.

Protocols: When developing protocols, first identify the questions needing answers as well as the desired correlations. Provide sufficient time for the technical team to thoroughly test the entire data collection process exactly as the crews are expected to collect the data. Make necessary corrections and adjustments. During training, share the experiences from these tests with the field crews.

Direct an expanded technical team to review the data collected in the pilot project and determine which portions of the protocol should be retained, modified, or deleted. The expanded technical team should consist of current members as well as other agency specialists and academia. "Simplify" should be the guiding principle when refining the protocols.

A comprehensive recommendation regarding protocol revision is not possible at this time. However, some aspects can be mentioned:

The *integrity of the point* must not be compromised. Provide better direction and training on how to determine what land cover is represented at the point. The area encompassing the circumference of the transect should guide that determination.

When *multiple ecological sites* are encountered, the procedure established for the pilot test should be used. This procedure is a compromise that resulted from hours of discussion among statisticians and resource specialists. In essence, the procedure does not compromise the integrity of the site or basic transect design. It does, however, make provisions for sufficient data to be collected on a given point.

The *plot design* used in the pilot is workable. The advantages of the design are:
- * it minimizes the occurrences of multiple sites and thus making data collection simpler,
- * it helps crews visualize what land cover the point represents, and
- * it provides a readily definable area to assess rangeland health.

The major disadvantage of the plot design is it is somewhat confusing. However, it quickly became a "non-issue" for the crews in the pilot project.

Review and revise range and *ecological site descriptions* prior to beginning the inventory.

Plan for sufficient time to identify *reference areas* to compare with similar sites.

Assure that the *production* procedures are understood by all team members. Production estimates are best done during the growing season and proper logistical planning is needed so that sites may be visited at suitable times. For example, desert sites should be visited in early spring while higher elevation sites should be visited in mid - to late summer. If possible, hire staff with local knowledge of local flora.

If the *cover* data proves beneficial, the revised procedures allow the work to be done in a reasonable amount of time. Furthermore, all crew members can assist. This cover data should not be conducted without a PDA, which expedites the collection process and minimizes errors.

Post-Work: The amount of *post-work* time would decrease by at least 75% if PDAs are used for data collection. However, continue to budget time for plant identification, soils sample preparation, general follow-up, and down loading of the PDAs to the data base.

Quality Control: When developing a work plan for the inventory, include sufficient time for quality control. If trade-offs must be made, choose quality over quantity. Designate one person to oversee and be responsible for data quality.

During training, stress the importance to calibrate by *double sampling*. Emphasize that double sampling is mandatory, not optional. A person responsible for quality control assures that double sampling is properly completed.

Conduct *regular checks* of the data collected by having different crews read the same transect (i.e., the *"flip-flop" technique*). Include checks in the logistics plan. A person responsible for quality control assures compliance and promptly evaluates the results in order that deficiencies may be quickly corrected.

Technical team members conduct frequent *technical reviews* during the early part of the field sampling season followed by regular checks throughout the inventory period by technical team members. Make sure that everyone providing guidance is "on the same page".

Do not attempt a similar inventory unless *PDAs* are utilized. The use of PDAs will improve data quality require less labor at the statistical lab.

Make sure that crews have good quality, powerful *cellular phones*. Most cellular phone companies are now waiving charges so accessibility should be less of a problem in future. Designate one person responsible for data quality to be the primary contact to get questions answered. Develop a back-up system when that person is not available.

If several crews are used for an inventory effort, arrange for them to *meet periodically* to discuss methods and resolve differences. The person responsible for data quality should be present at these gatherings.

B. The Bottom Line - Should NRI Continue to be Used to Meet BLM's Continuing Inventory Techniques?

The BLM needs an inventory to measure rangeland health, condition, and trend that is standardized, scientifically sound, statistically accurate, unbiased, and credible. That inventory should be universally accepted by the federal agencies that manage wild lands. The NRI can fill that need. Accordingly, BLM should pursue the use of NRI but only if BLM, NRCS, and the USFS formally agree to pursue the use of NRI for the rangelands they manage. (It would also be desirable to include the USFWS, NPS, and the Department of Defense (DOD) in the agreement.) The BLM must be a leader in this effort to assure that the agency's needs and requirements are met.

If an agreement can be reached, BLM should proceed as follows:

1. Establish an interagency technical group of experts in remote sensing techniques to review the data collected in the Colorado NRI Pilot. The purpose of the group is to determine what information and data collected during the pilot project may be gathered with remote sensing technology. Correlations between the remote-sensed information and the field-collected information may be sufficient to make significant reductions in the requirements for on-the-ground data gathering.

2. Use the technical team and other resource experts to review all of the data and correlations from the Colorado pilot project and assess the needs/opportunities to improve the results. Upon completion of the review/assessment, rewrite the handbook with a final set of protocols. This should be completed no later than February 1, 1999. The critical factor is that the final protocols must be done in time to ensure that the Personal Data Assistants (PDA's) are programmed and functioning for the FY2000 field season. No further NRI field work should be conducted until the data can be recorded into programmed, sufficiently tested PDAs.

3. When the data become available, estimate the cost to conduct NRI on all federal lands.

Officials from cooperating agencies must decide whether or not to proceed with NRI after weighing the benefits of the information against the costs.

If the decision is to proceed with NRI, BLM should proceed as follows:

1. Beginning in FY99, begin a two or more year funding stream for the completion of the data gathering for the statewide Colorado NRI. During the first year, conduct pre-work with the final protocols. Gather data and conduct analysis during the second and subsequent years. Also, select one or two states having the best combination of completed soil surveys and high quality ecological site descriptions and fund those states to complete an NRI inventory over a minimum of three years. The general time frames to conduct the inventory is as follows: Year 1- identify points, gather soils data, gather/buy aerial photos, etc. Year 2 - data collection and determination of the sample size to reach the desired confidence level. Year 3 - field data collection and data analysis.

2. Establish an on-going technical team that will monitor changing technologies, including the declassification of Department of Defense imagery, and develop uniform intra-agency standard modifications to the NRI process to make it better and less costly. This modification process

must be done in a way to ensure compatibility and usability of the historical NRI data to enable scientific documentation of trends in rangeland vegetation and soil stability.

3. It appears that Iowa State University is being stressed by the addition of the Colorado Pilot NRI. Therefore, establish a partnership with a western academic institution with strong programs in wild land management to process and analyze the NRI data from the public lands.

ACRONYMS

AMC	Arc Macro Language
AML	Arc Macro Language
ARS	Agricultural Research Service
ATV	All-Terraine Vehicle
BLM	Bureau of Land Management
BPA	Blanket Purchase Agreement
CSO	BLM Colorado State Office
DRG	Digital Raster Graphics
ECO	Environmental Careers Organization
EOD	Enter On Duty
FWS	Fish and Wildlife Service
FY	Fiscal Year
GRASS	Geographic Resources Analysis Support System
GSA	General Services Administration
IA	Interagency Agreement
ISU	Iowa State University
MLRA	Major Land Resource Area
NARCS	National Applied Resource Services Center
NRCS	Natural Resources Conservation Service
NRI	National Resources Inventory
PLGR	Precise Location GPS Receiver
PDA	Personal Data Assistant
PSU	Primary Sampling Unit
SUV	Sports Utility Vehicle
T&E	Threatened and Endangered
WM	Work Month
UTM	Universe Transverse Mercator
USFS	United States Forest Service

draft

APPENDIX A

NATIONAL INTERAGENCY AGREEMENT (IA)

NRCS A-3A75-7-194

INTERAGENCY AGREEMENT
BETWEEN THE
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
AND THE
U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

AGREEMENT NUMBER 1422P850-A7-0012

I. BACKGROUND

THIS INTERAGENCY AGREEMENT is made and entered into by and between the Department of Interior, Bureau of Land Management; hereinafter referred to as the BLM, and the Department of Agriculture, Natural Resources Conservation Service: hereinafter referred to as the NRCS. for the purpose of testing the application of NRCS's. National Resource Inventory (NRI) standards and protocol to public land in Colorado. The authority to enter into this agreement is the Economy Act of June 30, 1932, as amended (31 U.S.C. 1535).

The NRI is an inventory of land cover and use, soil erosion, prime farm land, wetlands, and other natural resource characteristics in the United States. The NRI also provides a record of the Nation's conservation accomplishments. Led by NRCS, the NRI has been used to determine trends in land use conversions, cropping change, conservation needs and resource needs, and resource conditions on the nation's private lands for the last 20 years. The NRI has an established infrastructure for data gathering and analysis. The data base is nationally consistent, statistically reliable, scientifically recognized, and credible with the public. The NRI is also adaptable to meet changing needs (i.e., the 1992 NRI was different from the 1987 project that was different from the 1982 project). The NRCS now extends the opportunity for other agencies and entities to use NRI as a means to provide needed information on other ownerships.

There are two major reasons why BLM is piloting a test of the NRI in 1997: 1) The condition of the public lands has long been a national debate, with interest groups and individuals expressing widely disparate views on the overall health of the public range lands. Data collected varies widely between states and is vulnerable to challenge. 2) Section 201(a) of the Federal Land Policy and Management Act and Section 4(a) of the Public Rangelands Improvement Act require BLM to inventory public lands and, in particular, develop and maintain an inventory of range conditions and trend on public rangelands updated on a regular basis. The NRI appears to have the capability to address these concerns. However to date, the NRI has been conducted on private lands and most of the lands have been crop land.

II. OBJECTIVE

The objectives for the pilot project will be: 1) field test the NRI approach for assessing rangeland health on public land administered by BLM, 2) determine if the NRI protocol or some variation is appropriate to meet BLM's continuing nationwide rangeland health inventory and reporting requirements, (3) provide opportunity for interagency cooperation to develop and standardize a methodology to assess the status of rangeland health on public and private rangelands and, 4) produce a project report that summarizes the results of field work, draws conclusions about rangeland health and other resource conditions from the data collected, documents shortcomings, strengths, and necessary modification with the NRI protocol; provide a cost accounting, and presents recommendations based upon this pilot regarding the future of NRI as a tool to present reliable information on the health of the nations rangelands.

The pilot project will involve the inventory of BLM administered lands in Colorado for FY 1997. The Colorado pilot project will test and gather field data on 300 Primary Sampling Units (PSUs) and two data collection units within each PSU. Most PSUs are located on the west slope. The pilot test will examine the operational aspects of what it will take to conduct all stages of NRI including analysis of data on public lands administered by BLM. It will produce a product that provides some information about the resources on the lands managed by BLM besides information obtained about operational aspects of the inventory. It is not designed to provide site-specific information such as what might be needed for a grazing allotment. The pilot test will provide information to determine the statistical design that would be needed to conduct a full NRI program on public lands.

III. STATEMENT OF WORK (DELIVERABLES)

NRCS will provide the following assistance and products for the Colorado BLM NRI Pilot Project:

1) CONCEPT

Provide assistance in developing goals and alternative study designs for a pilot demonstration project that will allow BLM to determine the feasibility of utilizing an NRI-like approach to obtaining information and analyzing natural resource issues on all BLM-administered lands.

2) PROJECT SAMPLING DESIGN

(a)Develop a sampling design that will help BLM meet the goals of the project.
(b)Select the sampling units (Primary Sampling Units and specific point locations) to be used for the project; provide to BLM in digital form for use by GIS staff.
(c)Provide documentation regarding rationale for selected sampling design, selection of the sampling units, and expected modifications for a National program.
(d)determine the statistical reliability for the Colorado Pilot.

3) PROTOCOL

Assist in developing of data elements and associated protocols to be used for Colorado Pilot. (a)Develop Rangeland Health Protocol. and modify to meet BLM needs for use in pilot. (b)Provide consultation in development of Soil Quality Profile Protocol (c)Modify 1997 NRI data elements and protocols to meet needs of pilot

4) DATA COLLECTION INSTRUMENTS

Develop data collection instrument to implement items listed above in Product #3. This instrument will assure that data recorded by Data Gathers can be utilized properly in final data base and during analytical stage (see Products #9 and #10) Develop and implement procedure to move data from this instrument to computer system at the Statistical Laboratory.

5) FIELD HANDBOOKS

Assist in development of Field Handbooks for use by Data Collection Teams.

6) FIELD TEST

Assist BLM in conducting a Field Test for Handbooks, Protocol. and equipment.

7) TRAINING

Participate in training of Data Collection Teams. particularly standard NRI protocols, Rangeland Health Protocol, soil mapping, use of PDA's, and use of Global Positioning Systems (GPS).

8) DATA COLLECTION ASSISTANCE

Provide two Soil Scientist to be part of Data Collection Teams. provide technical support, and provide quality assurance assistance.

9) DATA BASE

(a)Produce and provide preliminary statistical data base for initial BLM review and edit. (b)Provide a fully populated, functional SAS data base containing all variables and appropriate statistical weighing factors.

10) ANALYSIS & FINAL REPORT

Provide assistance to BLM in preparation final reports, including the following: (a)What was learned about the inventory process (e.g., data elements, protocols. training, staffing, cost, other operational issues. (b)Information about the condition of the public lands in Colorado. plus scenarios regarding how a National NRI would improve analytical capabilities. (c)Various alternative statistical designs that should be considered when expanding to a National program, including discussion regarding various reliability scenarios and cost.

BLM will provide:

III. COST REIMBURSEMENT

BLM will reimburse to the NRCS for those products outlined under the statement of work (deliverables) not to exceed $130,000. See attached table for expected cost reimbursement from BLM and NRCS contributions towards the Colorado NRI Pilot Project.

IV. REPORTS

The NRCS will work closely with BLM and will supply periodic reports on the field work, field reports and statistical summation of progress. The field data will be available for review and use by BLM field offices, and a report of progress due at the close of Fiscal 1997.

V. PAYMENTS

FY 97 funding in the amount of $130,000 for the Colorado NRI Pilot Project is provided to execute this agreement. BLM anticipates that funding in the amount of $130,000 (ceiling and not-to-exceed) will be available during FY 98. The NRCS will provide a bill supported with an itemized statement to the BLM no later than September 1, 1997. Similar arrangements would be required for payment in FY 1998. The NRCS will bill BLM via the OPAC system using the following information:

OPAC Agency Location Code:	14110008
BLM Account Number:	WO 220 1010 00 25 5Z - Obligate $65,000 WO 220 1020 00 25 5Z - Obligate $65,000
Interagency Agreement Number:	1422P850A70012

All correspondence associated with billing should be forwarded to:
U.S. Department of the Interior
Bureau of Land Management - WO 220
Rangeland, Soil, Water, and Wild Horse and Burro Group
1849 C Street N.W. Room 204LS
Washington, D.C. 20240

VI. TERMINATION

1 This agreement shall become effective on the date of signature of the BLM Contracting Officer and shall remain in effect for the remainder of FY 97, unless terminated by mutual written agreement of both parties. The Initiating Agency may terminate this agreement upon 30 days written notice of such termination. The Participating Agency shall be reimbursed for commitments extending beyond the effective date of termination to a date not later than the date upon which the agreement would have expired if not terminated under this paragraph, which the Participating Agency, in the exercise of due diligency, is unable to cancel. Payments made under this agreement, including payments under this article, shall not exceed the ceiling amount elsewhere specified in this agreement.

2. This agreement may be renewed for subsequent FY's (Not-To-Exceed a total of five), subject to the availability of Federal funding, by mutual written modification signed by both parties to this agreement.

VII. KEY OFFICIALS - The principal contacts for this agreement are:

National BLM Lead for NRI

Tim Hartzell - National Lead
Bureau of Land Management
Senior Rangeland Management Specialist
1849 "C" Street, NW (LSB-201)
Washington, DC 20240
(202) 452-5191

National NRCS Lead for Colorado NRI Project

Dennis W. Thompson
Natural Resources Conservation Service
Range and Grazing Lands Ecologist
Room 6150, P.O. Box 2890
Washington, D.C. 20013
(202) 720-5010

Colorado BLM NRI Project Manager

Dennis Zachman
Bureau of Land Management
2850 Youngfield Street
Lakewood, Colorado 80215
(303) 239-3883

Colorado NRCS NRI Project Manager

Dennis Alexander
655 Parfet Street
Room E200 - C
Lakewood, CO 80215
(303) 236-2886 Ext. 205

VIII. SIGNATURES

USDA - Natural Resources Conservation Service	USDI - Bureau of Land Management
BY	BY Modestenia Bush
GERLENE C. INMAN	Modestenia Bush
TITLE: Director, NHQ Administrative Support Division	TITLE: Contracting Officer
DATE: 7/9/97	DATE: 7/28/97

APPENDIX B

PLAN OF ACTION

DRAFT
Revised: 11/04/97

PLAN OF ACTION
for
a
National Resource Inventory (NRI) Project on Lands Managed by the Bureau of Land Management (BLM) in Colorado

PROJECT OBJECTIVE:

1) Test the National Resource Inventory (NRI) approach to monitoring resource data and other trends on public lands administered by BLM.
2) Determine if NRI or some variation is appropriate to meet BLM's and other federal public lands continuing inventory requirements under Section 201 of the Federal Land Policy and Management Act (FLPMA).

ACTION PLAN PURPOSE: This plan directs the development and implementation of an NRI pilot project on BLM land within Colorado.

INTRODUCTION AND BACKGROUND: The NRI has long been used by the Natural Resource Conservation Service (NRCS), formally Soil Conservation Service (SCS), to determine trends in land use conversions, cropping change, conservation needs, and resource conditions on private lands for the last 30 years. The NRCS now extends the opportunity for other agencies and entities the opportunity to utilize NRI as a means to provide needed information on other land ownerships.

PROJECT DURATION: It is anticipated that this project will be completed in an 18 month period. After this initial period, the pilot test should identify the applicability for Bureau-wide application.

PROJECT PHASES: The action plan for carrying out this pilot project can be divided into three phases as described below:

Phase I - Start-Up:

1. Select a ***Project Manager*** for the Colorado pilot. Responsibilities are:

* Provides overall leadership by coordinating activities, setting priorities and delegating responsibilities; the project manager is the final word in making decision in executing this project;

* In consultation with the technical committee and other agency officials, provide recommendations to NRCS regarding data elements and protocol for the test.

* Develops an action plan for accomplishing this project, which identifies what BLM needs/wants and identifies the level of data collection and method of analysis.

* Develops a public affairs plan to deal with internal and external contacts.

* Serves as the primary contact with field offices for this project.

* Serves as a focal point for communication with other agencies, entities, groups and partnerships.

* Informs management informed of progress and results.

* Develops and monitors the project budget and makes necessary adjustments as necessary.

* Assures adequate training is provided to individuals involved in the project.

2. Appoint a ***Technical Committee***. Responsibilities:

* Provide necessary technical support to the Project Manager.

* Define the processes and procedures to be used in the gathering and interpretation of the data.

* Identify interrelationships, connections, and possible linkages between this project and other projects being conducted in BLM and other agencies.

Issues this committee must address include but is not limited to:

- What data is needed to collect in order to meet project objective(s). What data already exists?
- Will woodlands and forest lands be addressed in the inventory? If so, how?
- What questions do we want answered?
- What will be the protocol for collecting the data?
- What additional information is needed that can be collected realistically, politically, and economically collected without confusing, complicating or jeopardizing the success in meeting project objective(s)?
- What analysis do we want and what can be made from the data?
- Are there interpretations that can be made to save data collection and supplement the analysis, e.g. how does health of the land relate to condition/ trend; can the canopy of pinon /juniper (P/J) be used to show condition?
- What analysis/interpretation can be made on treated lands - i.e. seeding, chained, burned areas?
- Will reporting information and trends using NRI meet requirements specified under Public Rangeland Improvement Act (PRIA) and other mandates?

- How will the data be used?

Membership of the Technical Committee will consist of individuals with the following expertise:

* Vegetation (grass, shrubs, and woodlands)
* Soils
* Monitoring/Inventory Techniques
* GIS/Remote Sensing
* Statistical Methods
* Ecology
* NRI -(knowledge of program from NRCS staff)

Note: The team should be not larger than ten (10) and consist of at least one scientist from outside of government.

PHASE II - Accomplish Field Work

The field work for this project is expected to occur during the late spring to early fall of 1997. Final determination on the means to accomplish the work will be made by the project manager upon consultation with and technical committee and agency officials. After examining the NRI process and protocol, it is determined that specialists with experience in gathering soils quality data are needed. In addition, specialists experienced in vegetative inventory techniques are also needed.

STAFFING PLAN:

Certain aspects of staffing the field crews are dependent on final decisions regarding the Primary Sampling Unit (PSU) points that data will be collected on. First of all, the number of crews that will be needed is dependant on the number of points that data needs to be collected on. Second, the exact duty station of all of the field crews cannot be finally determined until the location of the points is determined. Therefore, this staffing plan will provide two scenarios:

Scenario #1: In this scenario there are 300 PSUs. However, vegetation/rangeland health data need be collected on two of the three points in the PSU. Soils data will be collected on all three points.

Scenario #2: In this scenario, there are also 300 PSUs. However, vegetation, rangeland health, and soils data will be collected on all three points within the PSU (i.e. 900 points).

Note: On February 7, 1997 the decision was made to use Scenario #1 for the test pilot.

Staffing Plan Update 4/25/97:

In spite of exhaustive efforts, to date we have only been able to secure qualified staffing for three NRI crews. Because time is getting short as to when the crews are scheduled to begin work, the following modification regarding staffing has been made:

* The project will begin with 3 crews stationed in Gunnison, Montrose, and Grand Junction (Note: Because of previous committments and arrangements, a crew can not be stationed in Craig.)

* Beginning June 2, go to a maxiflex schedule with a basic four, ten hour day schedule. Crews are to work no more than 40 hours in a workweek. When in travel status in the northwest part of the state, a crew will begin the work week on Wednesday and conclude the

next Wednesday. Again, crews are to work no more than 40 hours in a workweek.

* In the event a qualified range conservation, technician, botanist, or ecologist becomes available, a forth crew may be established in Craig. This will be accomplished by moving the ECO soils scientist from Montrose to Craig and hiring a GS-5 Range Technician of equilivant. This scenario assumes that the two new positions will need to work with an existing crew to become familiar and proficient with the data elements and protocols.

* Under this strategy, the budget for staffing decreases but travel costs will increase. See budget request.

Staffing Plan Update 6/16/976:

* The services of a qualified range conservationist from the Coronado National Forest were obtained through an Interagency Agreement and two additional GS-5 Range Technicians were hired under temporary appointments; consequently a fourth team was formed. They will train with the Montrose crew the week of June 16 and begin work out of Craig after that.

ASSUMPTIONS (Common to Both Scenarios):

Composition of the Field Crews:

The nature of the inventory and the protocol necessitates that an experienced ***soils scientist*** (GS-11) be part of the team. An experienced ***vegetation monitoring specialist*** (GS-9) is also needed due to the complexity of the vegetation data gathering protocol and the rangeland health determinations that must be made. A ***resource technician*** (GS-5) that may lack field experience is also need to assist in the data gathering procedures. This will afford a great opportunity to gain valuable field experience for individuals who aspire a career in resources management.

It is anticipated that soils science expertise for the crews will need to come from NRCS. BLM has only a limited number of soils scientists and the lack current soils mapping and inventory experience. There are several potential sources for experienced vegetation monitoring specialists and several avenues will be pursued. Possibilities include current staff, retired annuitants, former temporary employees that have the necessary experience, and specialists from other agencies such as the U.S. Forest Service that may not be totally funded have funding problems. It is expected that college students will be the primary source for filling the resource technician crew member. The dates of the inventory (mid-April - mid-October) will likely put constraints on the students that will be available.

Pending the availability of soils scientist for the project, an option may be to conduct the soils work with an advance soils crew that would identify the point, conduct the soils work, and temporarily monument the point. Subsequently, the vegetation crew would come in and conduct the vegetation/rangeland health inventory. This option is less desirable because it does not afford valuable interaction between soils and vegetation specialist that are important in site correlations. Under this scenario, at least two soils scientists each with an assistant are needed.

Due to the uncertainty of the availability of soils scientists, another option worthy of consideration is to have all or a portion of the pilot project contracted. Concerns about using this approach are: uncertainty what the contractor bid will come in at, contractors are not allowed to use the PLGR GPS units which allow navigation to the point without post processing, and uncertainty if there is enough money in the overall budget to cover the government cost estimate.

Modification to Field Crew Composition (4/25/97):

The the crews are composed of a variety of individuals from a variety of appointments.
* *Soils scientists:* The NRCS will provide two soils scientists for the effort. Their home duty station duty station is in Nebraska. One soils scientist from the U.S. Forest Service (Fishlake Forest) in Utah will be detailed to be a crew member. A soils scientist from obtained from the Environmental Careers Organization (ECO) will begin working with an experienced soils scientist for the first part of the project and may bemoved to a fourth crew if the opportunity allows.
* *Vegetation Monitoring Specialists:* Two of the crews will have a Range Technicians (GS-9) that are hired from the vacancy announcement (CO-97-4). One of the crews will have an ecologist that is on detail from the U.S. Forest Service (Gunnison National Forest). If another vegetation monitoring specialist becomes available, a fourth crew will be assembled. Should a fourth vegetation monitoring specialist become available, approximately one to two weeks will be needed for training of procedures and protocols.
* *Resource Technicians*: Initially only two resource technicians will be hired from the vacancy announcement (CO-97-4) because the ECO soil scientist will be working with one of the crews.

Modification to Field Crew Composition (6/16//97):

* *Vegetation Monitoring Specialist:* The services of a qualified range conservationist from the Coronado National Forest were obtained throough an Interagency Agreement.
* *Resource Technicians:* Two additional GS-5 Range Technicians were hired under temporary appointments; consequently a fourth team was formed.

Tenure of the Crews:

The crews will begin April 21,1997; their appointment will end October 10, 1997 (25 weeks).

Modification to Tenure of the Field Crews (4/25/97):

Because the PDAs are not available, the starting date for the field crews is changed to May 12, 1997.

Duty Station of the Crews:

As discussed in the Introduction section, final determination of the duty stations will be made when a final decision is made on the location of the points. However, because this test is statewide and most of the lands administered by BLM in Colorado are on the west slope of the Rockies, it is assumed that as a minimum Montrose, Grand Junction, and Craig will serve as duty stations. These communities have BLM offices that can help provide support if needed.

Modification to the Duty Station of the Field Crews (4/25/97):

Duty stations will initially be located in Gunnison, Montrose and Grand Junction. Should a fourth crew be established, it will located in Craig.

Modification to the Duty Station of the Field Crews (6/16/97):

A fourth crew was assembled and will be duty stationed in Craig beginning June 23, 1997.

Training:

During the week of April 21,1997, the crews will be oriented and given the necessary safety training. The crews will also be assembling the PSU project folders and gathering needed data. During the week of April 28, 1997 the crews will be given field training at sites in the vicinity of Grand Junction, Colorado.

Modification to Training (4/25/97):

Training will be the weeks of May 12 and May 19. The agenda is as follows:

WEEK OF MAY 12TH -- 16TH

PURPOSE: Orient field crews in use of PLGR GPS units and PDAs; orientation to the data elements and protocols; aviation training, safety training, administrative orientation, and other logistics.

LOCATION: Bl M Colorado State Office, 2850 Youngfield St; Lakewood; from I-70, Take The 32nd St Exit to Youngfield St; BLM Office Is Located on East Side of Youngfield St. Across from the McDonald's Restaurant.

TIME: Meeting to Begin at 1 pm in the Conference Room on the 4th Floor; Ending at Noon on Fri., May 16.

AGENDA: *Monday (1:00 - 5:00pm)*

* 1:00 - 1:30 - Welcome and Introductions. (Zachman)
* 1:30 - 2:00 - NRI Pilot Project - Why??? (Zachman, Biggam)
* 2:00 - 3:00 - Administrative Orientation - Swearing In, Signing of Paperwork and Other Personnel Matters, Employee Conduct.
* 3:00 - 3:15 - Break
* 3:15 - 4:30 - Administrative Training - Timesheets, Travel, Credit Cards, Care of Equipment, Vehicles, Etc.
* 4:30 - 5:00 - Equipment, Accomodations, Schedules, File Management, Etc.

Tuesday (7:30am - 4:30pm)

* 7:30 - 9:30 - Orientation to the PLGR GPS Units (Biggam, Broe)
* 9:30 - 9:45 - Break
* 9:45 - 11:30 - Field Orientation to the PLGR GPS Units (Biggam, Broe)
* 11:30 - 12:30 - Lunch
* 12:30 - 1:30 - Organizing and Planning for Your Field Collection (Biggam)
* 1:30 - 2:30 - "Walk Through" the Workbook and Protocols (Habich, Et.al)
* 2:30 - 2:45 - Break
* 2:45 - 4:30 - Continue with "Walk-through"

Wednesday (7:30am - 4:30pm)

* 7:30 - 9:30 - Continuation of Walk Through, Review Ancillary Data.
* 9:30-9:45 - Break
* 9:45 - 11:30 - Safety - Vehicles (Barnhart)
* 11:30 - 12:30 - Lunch
* 12:30 - 2:30 - Aviation Safety Training (Meyer)
* 2:30 - 2:45 - Break
* 2:45 - 4:30 - Safety Training (Barnhart)

Thursday (7:30 - 4:30)

- 7:30 - 11:30 - Safety (Barnhart)
- 9:30 - 9:45 - Break
- 9:45 - 11:30 - Safety (Con't)
- 11:30 - 12:30 - Lunch
- 12:30 - 2:30 - First Aid (Rush)
- 2:30 - 2:45 - Break
- 2:45 - 4:30 - First Aid (Con't)

Friday (7:30 - 11:30)
- 7:30 - 9:30 - Insect and Disease of Trees (Williams, Forest Service)
- 9:30 - 9:45 - Break
- 9:45 - 11:30 - Wrap Up, Setting the Stage for next Week

WEEK OF MAY 19TH -- 23RD (GRAND JUNCTION, COLORADO)

PURPOSE: To Provide an Orientation of the Project to Field Contacts and Field Contacts; "Hands On" Experience for the Field Crews in Different Soil and Range Types

Location: Monday: Howard Johnson's on Horizon Drive (I-70 and Horizon Drive) Start @ 12:30 pm @ Howard Johnsons's Conference Room; Conclude @ 5::30 pm. Note: This Is a Change over Original Plans; Change Was Made to Accomodate Additional Attendees.

Tuesday - Thursday : Various Field Locations. If Inclement Weather, Will Meet in Bureau of Reclamation Office, 2764 Compass Drive, Grand Jct.; Go Southwest on Horizon Drive from Airport, Turn Right (NW) on Cross Roads Blvd.,Then North on Compass Drive; Bldg on Right (Sign out Front)

Friday: BOR Office

Starting Time Is 12:30 on Monday, the 19th --finish at 5:00; Wrap-up Morning of 23rd (Noon); Scheduled Field Time 20th - 22nd to Measure Selected Sites; Flexibility to Do Office Work as Needed at BOR Office

Agenda: *Monday: - May 19 12:30 - 5:00 Pm:*
Start @ 12:30 Pm @ Howard Johnsons Conference Room; Conclude @ 5::30 p.m. Note: This Is a Change over Original Plans; Change Was Made to Accomodate Additional Attendees. Attendees: Crew Members, Resource Area Contacts, Technical Team, Other BLM and NRCS Officials.

- 12:30 - 12:45 Welcome/ Introductions (Abbey / Zachman)
- 12:45 - 1:30 the Nri Pilot Project - a Washington Perspective (M. Sharpe - BLM, F. Busby- NRCS, C. Jett -NRCS, J.Fox - BLM).
- 1:30 - 2:30 A Walk Through the Data Collection Process (Zachman, Moderator)

Trainers:
- Soils - A. Amen/S.Davis/M. Sussek
- Line Intercept - M. Pellant
- Production - N. Habich
- Range Health, Noxious Weeds, Special Status Species - P. Shaver

- 2:30 - 2:45 Break
- 2:45 - 4:45 A Walk Through the Protocols (Con't)
- 4:45 - 5:00 Summarize/overview for the next Day (Pellant)

Tuesday - May 20 (7:30 - 4:30 Pm.) (Note : Bring Sack Lunch for the Day):
Travel to Staging Area (Desert Salt Shrubsite); When at Site Discuss Procedures; Need to Make Sure the Area Is Kept Free from Trampeling;
* Navigate to the Point with the Plgr.
* Will Walk Through the Protocols Systematically until a Land Use/cover Determination Is Made (It Is a Code 250 - Rangeland Site).
* Will Rotate Crews Through Data Collection Stations - Soils, Line Intercept (Cover), Production
* When All Have Gone Through the Previous Stations, All Will Congregate Together to Discuss Rangeland Health.
* Depart from the Site at 3:30 p.m..

Wednesday - May 21 (7:30 - 4:30 Pm.) (Note : Bring Sack Lunch for the Day):
* Inspect Reference Area -Sagebrush Site- (M.Pellant Lead Discussion)
* Crews Navigate to Preprogrammed Points @Sage Site
* Crews "Do it All" with Technical Team Assisting.
* Depart from the Site at 3:30

Thursday - May 22 (7:30 - 4:30 Pm.) (Note : Bring Sack Lunch for the Day):
* Inc. Training on Trees (B. Williams)
* Discussion on Procedures When Sites Change When Transect Is Laid out.
* Crews Navigate to Preprogrammed Points @ a Mixed Site (P/J Site); They "Do it All" with Assistance from Technical Team.
* Depart from the Site at 3:30p.m.

Friday - May 23 (7:30 - 12:00 Pm.):
* 7:30 - 8:00 Discuss Support Roles and Procedures for Crews to Get Support.(Zachman)
* 8:00 - 8:30 Resampling Sites (Habich)
* 8:30 - 9:00 Data Analysis
* 9:00 - 9:15 Break
* 9:15 - 9:45 Feedback to the Team on the Week (Technical Team)
* 9:45 - 10:30 Discussion on Expectations (Zachman)
* 10:30 - 12:00 Questions

Workweek Schedule:

When gathering field data, the crews will be on a 10–hour day, four–day work week. The crew will work five, 8-hour days during the week of week of April 21 (orientation, safety training, etc) and the week of October 5 (wrap–up, evaluations, etc).

Modification to the Workweek Schedule of the Field Crews (4/25/97):

* While the crews are in training, the crews will work Monday through Friday on 8-hour days. Beginning June 2, the crews will go to a maxiflex schedule with a basic four, ten hour day schedule. Crews are to work no more than 40 hours in a workweek. When in travel status in the northwest part of the state, a crew will begin the work week on Wednesday and conclude the next Wednesday. Again, crews are to work no more than 40 hours in a workweek.

Modification to the Duty Station of the Field Crews (7/7/97):

* Because a crew is now located in Craig, most crews will utilize the basic four, ten hour day. Occassionally, the maxiflex schedule will be utlized to allow for the crews to be on for eight,

ten hour days where efficiencies can be realized. Due to unanticipated amount of post work associated with data collection, overtime not to exceed 10 hours a payperiod is authorized for the crews.

Estimated Field Days:

To estimate the total number of field days three factors are considered. First, the crews will be working four days a week. Second, three holidays must be subtracted from the total field days. Third, 10% downtime (9 days) due to weather, mechanical troubles, etc.,must be subtracted from the total field days. Therefore, the total field days available for the project is as follows:

(88 days) - (3 holidays) - (9 downtime days) = 76 work days

Modification to the Estimated Field Days (4/25/97):

The estimate is modified as follows:

(80 days) - (3 holidays) - (8 downtime days) = 69 work days

In addition, there will likely be a day per pay period that will be needed to prepare and be efficient in their field work.

Update to Field Days 7/14/97

The estimate of actual field days originally estimated was high. Unexpected work associate with setup, logistics, and post work will reduce the actual field time associated with the project.

Estimated Travel:

The field crews will be in travel status during the first week. During the field season, it is estimated the crews will be in travel status 1/2 of the time (38 days). Anticipating that many of the points are in remote locations,the crew will be on camp rates for 19 days. We hope to secure travel trailers for the crews during this period. The remaining travel will be regular travel rates.

SCENARIO #1 - (300 PSUs, Data Collected on 600 Points)

Update: On February 7, 1997 the decision was made to use Scenario #1 for the test pilot.

Additional Factors for Estimating Costs:

One PSU can be completed by one crew in on work day. Therefore, four crews are need to complete the field work under this scenario:

300 PSUs / 76 work days = 3.9 or 4 work crews.

Update on Additional Factors:

The original estimate on the time it take to complete a PSU was greatly overestimated. Given the current rate, approximately 1.5 -1.7 PSU can be completed in a day.

Cost of Crews - Salary (figures rounded up to nearest 000):

Soils Specialist (GS-11):	
$18.50/hr x 40 hrs x 25 wks x 4 crews	= $ 74,000
Inventory Specialist (GS-9):	
$15.25/hr x 40 hrs x 25 wks x 4 crews	= $ 61,000
Resource Technician (GS-5):	
$10.00/hr x 40 hrs x 25 wks x 4 crews	= $ 40,000
Total	$175,000

Update - Cost of Crews - Salary 7/14/97:

The figures for salary costs have been revised to reflect actual conditions. See **PROJECT BUDGET.**

Cost of Crews -Travel (figures rounded up to nearest 000):

Orientation (Denver) - $430 x 12 crew members	= $ 6,000
19 Days @ $80/day - $1520 x 12 crew members	=$ 19,000
19 Days @ $20/day - $ 380 x 12 crew members	= $ 5,000
Total	$30,000

Update - Cost of Crews - Travel 7/14/97:

The figures for travel costs have been revised to reflect actual conditions. See **PROJECT BUDGET.**

SCENARIO #2 - (300 PSUs, Data Collected on 900 Points))

Additional Factors for Estimating Costs:

Under this scenario, a crew can complete 2.25 points per day:
900 Points / 76 days / 2.25 pts/crew/day = 5.25 crew.
It is not logical and cost effective to increase to 6 crews.

Therefore, assuming 5 crews:
5 crews x 2.25pts/day x 76 days = 855 points completed

Cost of Crews - Salary (figures rounded up to the nearest 000):

Soils Specialist (GS-11):	
$18.50/hr x 40 hrs x 25 wks x 5 crews	= $ 93,000
Inventory Specialist (GS-9):	
$15.25/hr x 40 hrs x 25 wks x 5 crews	= $ 77,000
Resource Technician (GS-5):	
$10.00/hr x 40 hrs x 25 wks x 5 crews	= $ 50,000
Total	$220,000

Cost of Crews (Travel):

Orientation (Denver) ----- $430 x 15 crew members	= $ 7,000
19 Days @ $80/day ----- $1440 x 15 crew members	= $ 23,000
19 Days @ $20/day ------ $ 340 x 15 crew members	= $ 6,000
Total	$ 36,000

PHASE III - Analysis, Interpretation, and Evaluation (AIE) for a Final Report

The project manager, with assistance technical committee, will be responsible for preparing the AIE and final report. The report will analyze and evaluate all operational aspects of the project and assess This is expected to be completed by March 1998.

PROJECT BUDGET: The total budget for this pilot project is estimated at $500,000 of which $330,000 is to be provided to the Colorado State Office in the FY97 AWP..

MAJOR BUDGET ITEMS	AMOUNT IN ($)
* WO overhead	$50,000
* To NRCS - (data input, computer runs/analysis statistical PSU layout, Personal Data Apparatus (PDAs), and other support).	$?????
* Project manager (PM)	$80,000
PM travel, supplies, equipment	$10,000
Technical committee (travel, misc.)	$4,000
Crew wages (see staffing plan)	$175,000 ($220,000 if five crews are used)
Crew travel/per diem (see staffing plan)	$31,000 ($36,000 if five crews are used)
GPS units - 8 @ $2000/unit	$16,000
Crew equipment/supplies (camping equipment, trailers/rental, fuel, misc.)	$12,000
Other logistical support (helecopter rental,etc.)	$10,000
Printing of Reports	$2,000
Vehicles - Assume: * full-size sport utility vehicle) *$290/month + $. 16/mile (estimate 100 miles/day)	$12,000 ($14,000 if five crews are used)

* vehicles used 17/days/month

TOTAL ESTIMATED COSTS $ [Contingent on Contributions to NRCS]

Update to the Budget 6/16/97:

The following reflects updated and refined cost estimates for the field operations of conducting the pilot project. It includes some givens and assumptions. The following does not reflect W.O.Overhead and contributions to NRCS:

NATIONAL RESOURCES INVENTORY
COLORADO BLM PILOT PROJECT
ESTIMATED COSTS (revised 6-16)

GIVEN: The following budget is for the entire project scheduled for completion in May, 1998.
GIVEN: The field season will begin with three crews located in Gunnison, Montrose, and Grand Junction. Until the fourth crew is established, the crews will need to be rotated on travel status to cover the northwest part of the state. When the crews are in the northwest portion of the state, they will need to be paid Sunday premium.
GIVEN: The field crews in Gunnison and Grand Junction will be comprised of a soil scientist, an experienced vegetation monitoring specialist, and a range technician (GS-5). The field crew in Montrose will consist of a soil scientist, an experienced vegetation specialist, and a soil scientist (Environmental Careers Organization (ECO) associate).
GIVEN: An ecologist and soil scientist from the Forest Service will be assigned as crew members via an interagency agreement. The Ecologist is located in Gunnison, CO., and travel expenses will be similar to the temporaries that are hires for the project. The soil scientist will be on detail from Richfield, UT; he will be returning to his home approximately five times during the field season.
GIVEN: Two of the soils scientists will be furnished by NRCS and funded under the provisions of the national Interagency Agreement for the project.
GIVEN: Field work will stop on October 10 due to the safety considerations of weather and the beginning of deer and elk gun seasons. Crews will be disbanded except for one person per crew to close up shop and deal with data questions. These people will remain working for an additional two weeks.
ASSUME: A fourth crew will be established to cover the northwest portion of the state; it is estimated that the fourth crew will be established in mid-June. A soils scientist would be moved from an existing crew in Montrose and supplemented with a Range Conversationist/Technician (GS-9), and a Range Technician (GS-5). Furthermore, an attempt would be made to fill in behind the soil scientist in Montrose with a Range Technician (GS-5). The experienced vegetation specialist will likely come in the form of a GS-11 Range Conservationist from the Forest Service in Arizona.
ASSUME: Salaries for temps multiplied by a factor of 1.0946 to account for Medicare, benefits, etc; salary for project manager multiplied by a factor of 1.17 to account for benefits, Medicare, etc. Cost of living increase in 1998 will be 3%.
ASSUME: Many of the sites are in remote areas and will require helicopter and other logistical support (e.g. horses).
ASSUME: Dollar figures round to the nearest '000

SALARIES

ECO associate (soils scientist)	-	15,000	
Soil Scientist (FS)	-	17,000	
Temps - Range Tech GS-9 (2)	-	30,000	
Temps - Range Tech GS-5 (2)	-	20,000	
Ecologist (FS)	-	18,000	
Est. Sunday premium (for NW part of state - $125/day for 18 weeks)	-	2,000	
Unavoidable Overtime (5 hrs/person/week @ $21/hr.)	-	17,000	Subtotal 119,000

Project Manager FY97 (80% of total time)	-	53,000	
Project Manager FY98 (60% of total time)	-	41,000	
			Subtotal 94,000

TRAVEL

For Soil Scientist (FS):			
Regular Rates $85/day x 108 days	-	9,000	
Camp Rates $31/day x 24 days	-	1,000	
Mileage 500 x .31/mile x 5 trips	-	1,000	
			Subtotal 11,000
For Temps, Ecologist, and ECO Associate:			
Denver $100/day x 5 days x 5 employees	-	2,000	
Mileage - 500 mi x .31 x 5 employees		1,000	
Camp $31/day x 6 wks x 4 days x 5 emp.	-	4,000	
Regular $85/day x 8 wks x 4 days x 5 emp.	-	14,000	
			Subtotal 21,000
For Tech Team:			
6 staff x 5 weeks x $85/night x 5 days	-		Subtotal 13,000
For Project Manager:			
2 weeks x $140/night x 5 days (2 trips to Washington D.C. + air fare)	-	2,000	
12 weeks x $85/night x 5 days	-	5,000	
			Subtotal 7,000
Trailer Setup in Field ($20/nt x 7 nights x 4 wk x 4 crews)	-		Subtotal 2,000
Other Supporting Travel: (for meeting rooms, pay travel for consulting specialists, etc.)	-		Subtotal 1,000

EQUIPMENT

PLGR/GPS Units	-	17,000	
Aerial Photos, GIS support materials	-	1,000	
Start -up Field Supplies (scales, tapes, soils equipment, etc)	-	9,000	
Field Supplies During Field Season	-	4,000	
Safety Supplies	-	1,000	
Cellular Phones, Radios	-	1,000	
Cameras - Film/Development (assume 1, 24ex/PSU)	-	3,000	
Trailer repair	-	3,000	
			Subtotal 39,000

HELICOPTER SUPPORT

$500/hr x 6 hr/day x 10 days			Subtotal 30,000

OTHER LOGISTICAL SUPPORT (horses, llamas, etc)			Subtotal 2,000
PRINTING			Subtotal 2,000
HARDWARE/SOFTWARE (for analysis)			Subtotal 5,000
VEHICLES			Subtotal 12,000
MISCELLANEOUS CONTINGENCY 3%			Subtotal 10,000
		TOTAL (for 3 crews)	**$368,000**

(WHEN FOURTH CREW IS ASSEMBLED)

SALARIES (Assume 17 weeks)

Range Conservationist (FS)	-	11,000	
Temps - Range Tech GS-5 (2)	-	15,000	
			Subtotal 26,000

TRAVEL

For Range Conservationist (FS):

Regular Rates $85/day x 90 days	-	8,000	
Camp Rates $31/day x 20 days	-	1,000	
Return Trips to Duty Station (2)	-	1,000	
			Subtotal 10,000
Regular Rates $85/day x 16 days x 2	-	3,000	
Camp Rates $31/day x 20 days x 2	-	1,000	
			Subtotal 4,000
Unavoidable Overtime (5 hours/person/week - @ $21/hr)		Subtotal 5,000	
Miscellaneous (supplies, unforeseen)		Subtotal 1,000	
		TOTAL (FOR 4 CREWS)	**$414,000**
Shutting down for the winter			5,000
Total for the project			**$419,000**

NOTE: This budget is for a pilot project where there is little or no experience in the process; therefore, it is impossible to accurately predict the total production for four crews. Up to this point in time production has been one-half point per crew day. However, one crew did manage to gather the data on two points that were very accessible and very simple. Crews will get quicker, and we have shorten the time to do the cover protocol. There seems to be an opportunity to shortened the time to complete the soils protocol; however, the overall quality of the soils data will be reduced if we make a major change. Given this information it is our best estimate that the above budget will accomplish the data collection on about 440 points (60 days x 4 crews x 1.6 points per day + 22 points known to be on private land + 21 points completed to date + rounding upward with optimism).

Note: Access to the points is turning out to be more difficult than anticipated; therefore additional helicopter time may be

needed.

Note: If the personnel can be found, additional crews will cost about $50,000 each.

BLM NRI PILOT PROJECT IMPLEMENTATION AND TIME FRAME SUMMARY:

IMPLEMENTATION ACTION OR OUTCOME	DUE DATE	RESPONSIBLE PARTNER	COMMENTS
Select Project Manager	10/1/96	BLM	
Select Technical Committee	10/30/96	BLM	
Technical Team meets to address issues, protocol, etc. - prepare recommendations to NRCS leadership.	11/18-19/96	BLM, NRCS, USFS	
Project proposals developed by the Technical Team to NRCS	2/16/96	Tech. Team	
Develop a Tentative List of Desired Products	1/31/97	Tech. Team	
Determine Final Sampling Distribution (NRCS)	2/7/97	NRCS	
Complete Staffing Plan	2/7/97	BLM	
Develop Timeline	2/7/97	BLM, NRCS (assist)	
Develop Communication Strategy	2/7/97	BLM	
Joint BLM/NRCS Meeting - Washington, D.C..	2/7/97	BLM, NRCS	To provide update on progress and provide direction and decisions.
Finalize MOU	2/14/97	BLM, NRCS	Use results of 2/7 mtg.
Finalize Equipment and Travel Needs; Begin Procurement Process	2/14/97	BLM	
Issue Vacancy/Interest Announcements for Summer Field Crews	2/14/97	BLM	

IMPLEMENTATION ACTION OR OUTCOME	DUE DATE	RESPON-SIBLE PARTNER	COMMENTS
NRI Conference (BLM/NRCS) - Denver	3/6-7/97	Tech. Team., NRCS (Goebel), ISU	Purpose to finalize decisions on data elements and protocol; critical attendees are Pat Shaver (NRCS) and Wayne Fuller from Iowa State University (ISU).
Develop Rough Draft Handbooks	2/26 /97 to 3/20/97	Tech. Team, NRCS	Incorporate protocols decided at the above meeting.
Vacancy Announcement Closes	3/14/97	BLM	
Applications Received From Personnel	3/10/97	BLM	
ROUGH DRAFT Handbooks w/ Protocols Completed	3/28/97	Tech. Team	Tech Team assignments due 3/21/97
Selection of Crews Completed	4/1/97	BLM	
NRI Field Test - Grand Junction	4/7-11/97	Tech. Team	
Finalize Handbook	5/9/97	NRCS, BLM (assist)	Revise draft as necessary
Crews on Board - Preparing Files, Orientation, Safety Training, Defensive Driving, etc.	5/12-16/97	BLM, NRCS (assist)	NRCS, BLM (assist)
Training of Field Crews (Using Final Handbook)	5/19/97 - 5/23/97	Tech. Team	Programmed PDAs are used for the field training.
Begin Fieldwork - Data Collection on PSUs and Data Points	5/27/97	BLM	Continuous quality assurance, quality control,communication, status; data is transmitted to ISU regularly. Note: In a meeting held at ISU on July 28-29, a decision was made to decrease the sample sizefrom 600 points to 450.
Complete Fieldwork	10/10/97	BLM	All data is submitted to the statistics lab at ISU Note: Filed work was completed on October 10; however, additional wark on "cleaning up the files" using crews and the technical team was needed before submitting to ISU see amended time table following this table.

IMPLEMENTATION ACTION OR OUTCOME	DUE DATE	RESPON-SIBLE PARTNER	COMMENTS
NOTE: THE FOLLOWING PORTION OF THE SCHEDUEL HAS HAS BEEN REPLACED; SEE THE TABLE ON PAGE 18 OF THIS DOCUMENT	------------	------------	---
Preliminary Data Base is Prepared	10/6-31/97	NRCS (ISU)	Completed at ISU
BLM Receives Preliminary Database for Review and Analysis	11/3/97	ISU	From ISU
BLM Reviews and Submits Findings to ISU	11/3/97 - 11/28/97	BLM, NRCS (assist)	
ISU Finalizes Database; submits to BLM	12/15/97	NRCS (ISU)	
Review and Analyze the Final Data Base; Desired Products are Prepared	12/15/97 - 3/15/98	BLM, NRCS	
Draft Report is Prepared	1/1/97 - 3/15/98	BLM, NRCS (assist)	Provided to BLM and NRCS for comment
Draft Report is Reviewed and Comments are Provided to the Project Manager	3/15/98 - 4/15/98	BLM, NRCS	
Report is Finalized and Briefings Provided	4/15/98 - 5/30/98	BLM, NRCS (assist)	To BLM and NRCS
Public Notified of the Findings	6/1/98 - 6/30/98	BLM, NRCS (assist)	

Update to the Schedule 7/14/97:

The schedule following the completion of field work in the schedule may be modified pending decisions regarding extending data collection into Spring, 1998.

Update to the Schedule 7/28/97:

A decision was made that no additional field work would occur in 1998; therefore the sample size was reduced and decision made to have a preliminary final report completed by March 31, 1998.

BLM NRI PILOT PROJECT IMPLEMENTATION AND TIME FRAME SUMMARY:

(MODIFIED FOR NOVEMBER, 1997 THROUGH MAY, 1998)

IMPLEMENTATION ACTION OR OUTCOME	DUE DATE	RESPON-SIBLE PARTNER	COMMENTS
TECHNICAL TEAM - DATA REVIEW	10/28-29/97	TECH TEAM, PROJECT MGR.	
FINAL DATA CLEANUP AND FILES TO I.S.U.	12/5/97	PROJECT MGR.	INCLUDED CLEAN UP BY CREWS AND TECHNICAL TEAM; ISU HAS BEEN RECEIVED FILES FOR DATA INPUT FILES SINCE AUGUST, 1997; AS FILES ARE COMPLETED THEY WILL CONTINUE TO BE FORWARDED TO ISU.
DRAFT OUTLINE OF THE REPORT	11/26/97	PROJECT MGR.	
PRELIMINARY DATA BASE IS PREPARED	12/31/97	ISU	
ANALYSIS OF DATA	1/1 - 3/15/97	PROJECT MGR., TECH TEAM, NRCS	REPORTS PROVIDED TO PROJECT MGR. FOR INCORPORATION INTO THE REPORT.
DRAFT OF THE REPORT DEALING WITH THE OPERATIONAL ASPECTS OF THE PROJECT	1/23/97	PROJECT MGR.	IN CONSULTATION WITH TECHNICAL TEAM; DRAFT PROVIDED TO TECHNICAL TEAM AND W.O. OFFICIALS FOR REVIEW AND COMMENT.
PRELIMINARY FINAL REPORT COMPLETED	3/31/97	PROJECT MGR.	RESULTS PROVIDED TO TECHNICAL TEAM AND TO W.O. OFFICIALS (BLM AND NRCS) FOR REVIEW AND COMMENT.
REVIEW OF THE PRELIMINARY FINAL REPORT	4/1 - 5/9/97	TECH TEAM, W.O. (BLM & NRCS)	
FINAL REPORT DISTRIBUTED	5/31/97	PROJECT MGR	

APPENDIX C

TECHNICAL TEAM,
RESOURCE AREA CONTACTS,
AND OTHER KEY INDIVIDUALS

Bureau of Land Management
National Resource Inventory
Pilot Project - Technical Team
revised:1/22/98

Name	Agency/ Group	Address	Phone	FAX	E-Mail
Dennis Zachman	BLM - Colorado State Office	2850 Youngfield Lakewood, CO 80215	303-239-3883	303-239-3808	dzachman@co.blm.gov
Johnnie Riel	"	"	303-239-3717	"	jriel@co.blm.gov
Scott Davis	"	"	303-239-3721	"	s2davis@co.blm.gov
John Foster	"	"	303-239-3901	303-239-3931	jfoster@co.blm.gov
Pete Biggam	NRCS	655 Parfet - RME200C Lakewood, CO 80215	303-236-2910 Ext. 243	303-236-2896	pbiggam@co.nrcs.usda.gov
Pat Shaver	NRCS	202 Strand Ag. Hall Corvallis, OR 97331-2218	541-737-7355	541-737-0504	shaverp@ccmail.orst.edu
Ned Habich	BLM/ NARSC	P.O. Box 25047 Denver, CO 80225-0047	303-236-0166	303-236-3508	nhabich@blm.gov
Al Amen	BLM/ NARSC	"	303-236-0154	303-236-6450	aamen@blm.gov
Bill Williams	BLM/ NARSC	"	303-236-0158	303-236-3508	w30willi@blm.gov
Mike Pellant	BLM/ Idaho State Office	1387 S. Vinnel Way Boise, ID 83709	208-373-3823	208-373-3805	mpellant@iso.blm.gov
Rita Beard	USFS	3425 E. Mulberry Ft. Collins, 80524	970-498-1715	970-498-1660	
Mike Sucik/Josh Saunders	NRCS/ Soil Quality Lab	P.O. Box 400, Akron, CO 80720	970-345-2259	303-444-2986	m.sucik@co.usda.gov
Ken Spaeth	NRCS	800 Park Blvd., Plaza IV, Ste 105 Boise, ID 83712	208-422-0729	208-334-1502	k.spaeth@nwrc.ars.pn.usbr.gov

Other NRI BLM Pilot Project Contacts:

Tim Hartzell	BLM W.O.220	1849 G Street Washington, D.C. 20240	202-452-5191	
Dennis Alexander	NRCS Colorado	655 Parfet St. Rm E200C. Lakewood, CO 80215-5517	303-236-2886 #205	
Dennis Thompson	NRCS W.O.	P.O. 2890 Room 6150 Washington, D.C. 20013	202-720-5010	
Jeff Goebel	NRCS W.O.	P.O. Box 2890 Washington, D.C. 20240	202-690-2019	jgoebel@usda.gov FAX:202-690-3266
Bob Schmidt	BLM CSO	2850 Youngfield Lakewood, CO 80215	303-239-3801	
Jay Breidt	Iowa State U.	Stat Lab	515-294-5242	jbreidt@iastate.edu FAX:515-294-2456

Colorado BLM NRI Pilot Project
Resource Area Contacts

BLM Field Contact	Office	Phone	FAX
Greg Goodenow	Little Snake RA	970-323-5087 700-323-5071	970-824-8881
Dave Harr	Kremmling RA	970-724-3437 700-327-5609	970-724-9590
Lane Osborn	White River RA	970-878-3601 700-386-5516	970-878-5717
Art Hayes	Gunnison RA	970-641-0471 700-859-4452	970-641-1928
Gary Thrash	San Juan RA	970-385-1371	970-385-1375
Amanda Clements	Uncompaghre RA	970-240-5306	970-240-5367
Tom Grette	Royal Gorge RA	719-269-8534	719-269-8599
Mike Cassels	San Luis RA	719-589-4975	719-589-9152
Harley Metz	Grand Jct. RA	970-244-3076	970-244-3083
Carla Scheck	Glenwood Springs RA	970-947-2815	970-947-289

APPENDIX D

MEETING NOTES
MARCH 6-7, 1997
WITH RECOMMENDED PROTOCOLS

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RESULTS OF
JOINT BLM/NRCS MEETING
NRI PILOT PROJECT - BLM
March 6-7, 1997

Location: **Colorado State Office**
2850 Youngfield
Lakewood, CO 80215

Purpose: **To make final decisions on the data elements and protocols for the NRI pilot project.**

Identify how the decisions will affect the timeline, staffing, training, programming of PDAs, and assignments (who does what by when)

Information sharing

Finalize Interagency Agreement deliverables.

March 6 (Thursday)

8:00 - 8:30 Introductions/ Meeting Expectations (Dennis Zachman/ Marion Malinowski-facilitator)

Attendees:
BLM- Dennis Zachman, John Riel, Scott Davis, Bob Schmidt, Ned Habich, Bill Williams, Al Amen, Eric Luse (Bob Abbey joined the group in for the afternoon of March 6)
NRCS - Jeff Goebel, Dennis Alexander, Duane Johnson (morning of March 6), Pat Shaver, Pete Biggam, Dennis Thompson
Iowa State University- Wayne Fuller, Jay Breidt

8:15 - 8:30 Status of the Project (Zachman)

Summary: Handed out plan of action, info sheet, and recommendation letter. Primarily discussed staffing issues. Are considering the potential of contracting the project along with other options.

8:30 - 8:45 Update on Survey Design for the Pilot Project (Jeff Goebel)

Summary: Jeff provided some information on the selection of the PSUs and points for the project. He tried to use some of the same stratification concepts in determining what PSU points will be used for the pilot. Handed out a tech paper entitled "The National Resources Inventory: a long-term multi-resource monitoring program." Pilot is designed to : examine operational aspects of what it takes to conduct NRI; produce a product that will provide some information on BLM lands; provide information to assist in statistical design of full NRI-style program on all BLM lands; opportunity for interagency cooperation, and provide a summary on what we learned.

8:45 - 9:15 Overview of the PDAs (Pete Biggam/Iowa State University)

Summary: Information/demonstration of the PDAs by Pete. They use anewton system and have their own perating system. In past used a worksheet. Has rechargeable battery pack. Once data has been entered, it can not be changed unless downloaded again from ISU.

9:15 - 11:30 "Walk-Through" the Recommendations (Marion Malinowski and Martha Maxwell - facilitators)

Summary : Additional Concerns/Issues: concern about using a contractor for the work (can't use PLGR GPS unit - would have the additional cost of having to have a federal employee locate the point), quality control.

A. "FREEING THE POINT" : This recommendation was made so that the soils could be correlated with rangeland data; Wayne Fuller led the discussion on this issues and explained the problems with statistical reliability if the point is moved; emphasized that the data must be definsible; it is critical that the procedures for identifying the point be identified and clear in the instructions:

> **DECISION:** 1. The point is the point; it will not be moved 2. Build in a data field to identify situations where the transect transcends into a different soils type with different rangeland characteristics. **Affects:** This means that the site must be located with a PLGR GPS unit which means it would have to be a federal employee.

B. PLOT DESIGN: given that the point must not be moved there was considerable discussion on what the plot design should be. Two important goals of the design are to be able to correlate the range site with the soils and to determine range site health. If the transect crosses over into a a different range site with different soils, this data will need to be collected for the new soils type which means soils type will need to be verified. Discussion ensued about adjusting the transect so that it would not cross over onto the the different range site. This was determined unsatisfactory by the statisticians because it would cause the data to be unreliable. A fixed plot must be used to assure reliability of the data.

> **DECISION:** 1. Use a fixed plot designed that will not be varied. The point drives what datais collected. 2. To minimize the possibility that the transect will not cross into a new range site/soil, a circular plot will be used that radiates out 75' from the center which is the PSU point. The north, south, east, and west axis will serve as transects lines for canopy cover. Three (3) micro (for gathering production data on the herbaceous cover) and three (3) macro plots (for gathering production data on the woody species) will situated along north and the south axis and two (2) micro and two (2) macro plots will be situated along the east and the west axis. Rangeland health will be gathered within the 75' radius circle macroplot. 3. If a situation is encountered where the transects transcends range sites with different soils the following will be followed: data will be gathered on the plots and soils data will be gathered not only at the point but also in the new range site . It is not critical where the soils data is gathered in the new range site, only that it is gathered. Protocol needs to address this situation. 4. If a point falls on a road, lake, significant rock outcrop - it is noted but no data is taken.

C. TREE DATA: Bill Williams led a discussion on what tree data is collected for the pilot.

> **DECISION:** If the point definitely lies on commercial forest land, it is noted but no data is collected. For all other situations, tree information will be gathered as follows: canopy (cover) will be dealt with in the line intercept, tree count by sized species, disease using the circular plots. Bill will develop the protocol and data element needs. It was determined that forest lands health is beyond the scope of this project and a forest land health assessment will not be part of this pilot. This reverses part of general Recommendation #11.

D. OTHER DECISIONS (assume the final/amended final recommendation is adopted unless otherwise noted):

> 1). There is uncertainty regarding agency responsibilities in the following situations: 1) One or more points in a PSU are on private land; or 2) points within a PSU lie on both BLM and USFS land. Also, does BLM collect PSU data on non-federal land in a PSU? Likewise, does NRCS collect data on federal lands?
>
> *Recommendation:* *NRCS provide clarification and direction.*
>
> **FINAL RECOMMENDATION :** Based on the feedback we received from NRCS, we understand that if a point falls on private land, NRCS will be notified and NRCS will complete the work on that point. If a point falls on other federal land such as Forest Service, it will be noted as such but no further work completed. NRCS will gather PSU data for private lands and provide to BLM.
>
> **DECISION - MARCH 6/7 MEETING:** The change to the recommendation is that if private land lies within a portion of the PSU, NRCS will populate the PSU data. lies within the

2). There is significant concern on the concept of "freeing the point" on federal lands as this will affect data gathering on elements such as soils, vegetation, ownership, riparian, land use, and land cover.

> *Recommendation: NRCS provide protocol. Whatever protocol is developed, the Technical Team recommends that all data is gathered from the selected point.*
>
> **FINAL RECOMMENDATION:** After further consultation, we understand that the concept of "freeing the point" is no longer used (i.e. the point is not moved and appropriate information is gathered on the point, wherever it happens to lie). The technical team has serious concerns over this policy when the point happens to lie on certain soils inclusions. First, the data gathered on the point should correlate with a known soil series or soil series phase. Second, ultimately BLM wants to be able to interpret soil site information; inclusions provide no such data. (i.e ecological sites are developed on soil series and soil series phases, not on inclusions). We strongly recommend that this policy be modified to allow the point to be moved when a point happens to fall on a soils inclusion that cannot be correlated to an ecological site description. Instructions for moving the point should be provided by NRCS. Specifically, clarification needs to be provided in the following situations: 1) the point falls within an inclusion that is named in the map unit; 2) the point falls within an inclusion not named in the map unit, and 3) the point occurs within a map unit that is inappropriately named.
>
> **DECISION - MARCH 6/7 MEETING:** See "A" above.

3) Much discussion centered upon the role of riparian resources and whether they should be considered in the NRI, especially in light of BLM's existing data base system.

> *Recommendation: Additional discussions with BLM riparian experts (i.e. Wayne Elmore, et. al.) should be made by the technical team. By December 17, provide a complete recommendation to NRCS on all aspects of utilizing riparian in the NRI pilot.*
>
> **FINAL RECOMMENDATION:** Add no new procedures for riparian to the test at this time. Upon evaluation of the location of the PSU and related points, make final recommendations on procedures by February 28, 1997.
>
> **DECISION - MARCH 6/7 MEETING:** It is not anticipated that this will be encountered very often. If a point lies within a riparian area, use the NRI protocols for collecting data.

4). Many NRI data elements ask for previous years data. Supplying previous years information could be time consuming and possibly speculative.

> *Recommendation: Collect data for 1997 only.*
>
> **FINAL RECOMMENDATION:** Data for previous years will be populated only if easily and readily accessible.
>
> **AMENDED FINAL RECOMMENDATION:** After further discussions with Jeff Goebel, previous years' data will not be populated.
>
> **DECISION - MARCH 6/7 MEETING:** Amended final recommendation is adopted.

5) For elements and data that will not be populated, what protocol should be used (e.g. N/A, auto populate, etc.)

> *Recommendation: NRCS provide protocol and procedures.*
>
> **FINAL RECOMMENDATION:** NRCS advises that procedures for not populating an element are already in place.
>
> **DECISION - MARCH 6/7 MEETING:**

6) When a point falls upon land where unauthorized use exists, what should be done? (e.g. BLM land that is being cultivated or irrigated without authorization).

Recommendation: *NRCS provide protocol and procedures.*

FINAL RECOMMENDATION: NRCS advises that data is collected and recorded in such circumstances.

7) General data collection is a concern:
* Can they be customized to meet BLM needs?
* Are GPS/PDA units available?

Recommendation: *NRCS provide feedback.*

FINAL RECOMMENDATIONS: NRCS advises that special customizing of PDAs is not likely. Continue to look for economical means for procuring this equipment for the pilot project.

AMENDED FINAL RECOMMENDATIONS: After further consultation with NRCS, the PDAs can be programmed to meet approved needs.

DECISION - MARCH 6/7 MEETING: PDAs will be programmed per the decisions made. NRCS will procure the PDAs (will be part of the MOU; 14 will be obtained); BLM will procure 8 GPS units.

8) Should points be permanently marked?

Recommendation: *Permanently mark sites by simple means (e.g. rebar).*

FINAL RECOMMENDATIONS: Upon further consideration we have decided not to permanently mark the sites.

DECISION - MARCH 6/7 MEETING: The points will not be permanently marked. Depending the method for field gathering, temporary marking of the site may be needed.

9) Where are completed rangeland health forms sent? Where are case files located?

Recommendation: *NRCS provide information.*

FINAL RECOMMENDATION: In discussing this issue with NRCS staff, we understand that the data that is collected is submitted to and housed at the lab at Iowa State University. Files that are prepared for each PSU are housed at the BLM Colorado State Office.

DECISION - MARCH 6/7 MEETING: Same as final recommendation.

10) Is rangeland health a subsample? If so, what will the size of the subsample be?

Recommendation: *NRCS provide answer.*

FINAL RECOMMENDATION: It is our understanding that rangeland health data will be gathered on all sites, including woodland sites.

DECISION - MARCH 6/7 MEETING: Same as final recommendation.

11) Concern was raised about forest land and how it will be addressed in this pilot. Some general recommendations regarding the issue are needed.

Recommendation: *Develop a new module for point data that describes forest land in terms of vegetation cover. Analyze what modifications to rangeland health are needed to address forest lands. If the decision is affirmative, assemble a team of interagency experts to develop this* *module and protocols.*

FINAL RECOMMENDATION: The technical team feels that eventually forest lands needs to be part of the NRI inventory. However, we understand that it may be premature to incorporate significant changes to the NRI instrument and protocol for forest lands at this time. However, we recommend the following for this test:

- Point Data Module IV., Level 1 definitions for tree cover should be expanded to include western forest land species.

- Point Data Module V.A., should be modified to include a code "340" that does not identify the land as grazed or ungrazed.

- Point Data Module V.G., should be modified to include a code for aspen.

- Develop no new module for forest land characterization data. However, for this test, collect characterization data on a subset of points that are forest land. Collected data will be similar to that proposed for woodlands. The data will not be included in the NRI at this time but will give information to include in our report.

- At this time, do not add a forest land health assessment. However, develop a protocol that could be tested on a subset of forest land points to show how a forest land health assessment might work and how it could be integrated into the NRI. ent to the NRI data base. The protocol for this test will be developed by the technical team in consultation with experts as needed.

DECISION - MARCH 6/7 MEETING: See Point Data recommendations for the first three bullet items. Also see "C" above regarding the data that will be collected and the forest health assessment recommendation..

12) Concern was raised about how woodlands will be addressed and described in the BLM pilot. .

Recommendation: Adopt the recommendation contained in the Summary Report titled "Coordination of SCS pinyon/juniper Soil Site Correlation and Technology Transfer Programs in the West Region" (dated April 18-21, 1989). The recommendations should be extended to other savannah types such as bristlecone pine, limber pine, etc. Also consider development of modules and protocols similar to that of forest land described in general Recommendation 11.

FINAL RECOMMENDATION: We feel very strongly that additional data concerning woodlands (i.e pinon, pinon/juniper, juniper) be collected in the 1997 NRI pilot test. Woodlands comprise a significant amount of public lands and the current protocol for addressing true woodland sites in the NRI is not adequate. Many on the team felt that true woodlands should be delineated from rangelands and separate a separate methodology developed. However, after much consultation, it was decided not to recommend that woodlands be separated from rangelands. However, we have recommended several actions to address the woodlands concerns:

- Point Data Module IV., Level 1 definitions for tree cover should be expanded to include woodland species such as pinon and juniper

- Point Data Module V.A. should be modified to include a field codes for pinyon/juniper (as well as other applicable cover types) as identified in the Society of Range Management's (SRM) "Rangeland Cover Types of the United States", 1994. These classification are nationally recognized and better represent the variety and types of lands administered by BLM in Colorado. See Point Data Module V.A. for detail.

- Point Data Module V.G. should be modified to include codes for pinon, juniper, pinyon/juniper, and bristlecone pine.

- Point Data X. should be modified to include entries that typify situations encountered on public lands administered by BLM. Examples include prescribed fire, converted rangeland (eg. trespass, fire), exotic annual grasses, etc.

- Collect woodlands characterization data including # of stems by height class and age class, # of dead tree stems by species, and # of damaged or unhealthy trees. Incorporate into the field methodology for 1997. See Attachment 2.

DECISION - MARCH 6/7 MEETING: See the Point data recommendations and "C' above.

13) Concern about the ability to provide adequate soils expertise for the pilot was expressed.

Recommendation: Will NRCS be able to provide soils staff assistance?

FINAL RECOMMENDATION: By January 31, NRCS provide feedback to BLM on possible support for soils expertise.

DECISION - MARCH 6/7 MEETING: The NRCS announced they are prepared to supply 2 soils scientists for the project, whether in the capacity as crew membeers or as advisors. BLM will provide travel expenses. This will be built into the Cooperative Agreement.

PSU DATA ELEMENTS

Comments and recommendations correspond to the Module (Roman numeral) and Data Element (alpha-numeric) for the 1992 instrument. Correlation with the 1997 instrument is made where appropriate.

II. (General Information) - There should be way to track it to a BLM district.

Recommendation: Add a data entry field for BLM district offices.

FINAL RECOMMENDATION: As a result of BLM reorganization efforts, not all states may have district offices. Therefore modify data entry to make the entry "BLM Field Administrative Office".

DECISION - MARCH 6/7 MEETING: GIS will take care of this base layer. It is not a field issue. We will be able to query the data by either Resource Area or District. [NOTE: Does BLM need to supply this to ISU?, also does this correlate with one of the elements in new modules?].

IV. (Farmsteads and Built-up Areas) This module does not include enough elements to encompass BLM needs such as communication sites.

Recommendation: Expand to include items such as communication sites or create "C" for BLM in the module.

FINAL RECOMMENDATION: Expand to include items such as communication sites; also we recommend that section "C" for BLM be created in the module to better reflect the circumstances encountered:

C. Land Changes (40 acres or greater)
1. Rangeland
2. Seeding
3. Weed Dominance
4. Woodland
5. New Burn (current year)

This section would give more information at a landscape level and provide capability to determine if things like pinon/juniper, weeds such as cheatgrass, etc. are increasing in the PSU.

AMENDED FINAL RECOMMENDATION: We recommend that section "C" for BLM be created in the module to better reflect the circumstances encountered:

C. Public Land Structures and Land Conversions

1. Adminisratative Sites (area within the PSU to the nearest acre)
For handbook: Includes communication sites and campgrounds.
2. Energy and Mining Disturbances (area within the PSU to the nearest acre)
3. Landfills and Dumpsites (area within the PSU to the nearest acre)
For handbook: Includes authorized landfills, unauthorized dumping, and dead carcass sites.
4. Agricultural Use (area within the PSU to the nearest acre)
For handbook: Includes irrigation systems, irrigated lands, and agricultural crops such as hay, alfalfa, marijuna, wheat, etc., that are harvested mechanically or by hand.
5. Structures -linear (area within the PSU to the nearest acre)
For handbook: Includes powerlines, pipelines, and roads. Include only disturbed area.
6. Manipulations - mechanical/chemical (area within the PSU to the nearest acre)
For handbook: Includes herbicides, seedings, chainings, roller chopping, burns, terracing, reclaimed land actions.
7. Weed Dominance - i.e. the majority of the vegetation in the PSU is weed species (area in the PSU to the nearest acre)

DECISION - MARCH 6/7 MEETING: It was decided to **not** include most of this data in the inventory. Roads continues to be a concern and must be adressed in the element " rural transportation facilities -- acres of roads. Expand to meet BLM needs with two or more classes (especially situations such as two-track trails)

VI. (Water Areas) Should this be the place where riparian is added? Should a new module addressing riparian be developed?

Recommendation: See General Recommendation #3.

FINAL RECOMMENDATION: At this time, add no new procedures for riparian to the test. Upon evaluation of the location of the PSU and related points, make final recommendations on protocol by February 28, 1997.

DECISION - MARCH 6/7 MEETING: If a point lies within a riparian area, use the NRI protocols for collecting data.

POINT DATA ELEMENTS

Comments and recommendations correspond to the Module (Roman Numeral) and Data Element (Alpha-numeric) for the 1992 instrument. Correlation with the 1997 instrument is made where appropriate.

I. (Ownership) Should a code for BLM and Forest Service be added?

Recommendation: Add a code for BLM and Forest Service.

FINAL RECOMMENDATION: No change in recommendation. Add a code for BLM and Forest Service.

DECISION - MARCH 6/7 MEETING: This recommendation has already been completed and included in the 1997 Point Module #1..

III. (CRP Information) Do we consider anomalies BLM administers such as Land Utilization (LU) and Reclamation Withdrawals in this module? It doesn't seem to be a real good fit.

Recommendation: NRCS should develop an additional module to meet these needs.

FINAL RECOMMENDATION: No change in recommendation. NRCS develop an additional module to meet these needs.

DECISION - MARCH 6/7 MEETING: No additional data will be incorporated into this module (Point Module #3 for 1997.

IV. (Earth Cover) Should BLM collect this information beyond Level 1. No specific recommendations are made by the team.

FINAL RECOMMENDATION: Point Data Module IV., Level 1 definitions for tree cover should be expanded to include woodland species such as pinyon and juniper and western forest species. See cover memo.

DECISION - MARCH 6/7 MEETING: drop this recommendation. Data will be gathered in the cover transects and included in Point Module #4 for 1997.

V..A. (Land Cover/Use) Do we populate for prior years?

Recommendation: Populate for 1997 only. See General Recommendation 4.

FINAL RECOMMENDATION: Populate previous years data only if easily and readily available.

DECISION - MARCH 6/7 MEETING: Previous years data will not be gathered.

V.A. (Land Cover/Use) How do we deal with pinyon and juniper in these descriptions. Several concerns were made about how "p/j" is described in the NRI.

Recommendation: See General recommendation 11.

FINAL RECOMMENDATION: Point Data Module V.A. should be modified to include field codes for applicable cover types (including pinyon/ juniper) as described in the Society of Range Management's (SRM) "Rangeland Cover Types of the United States", 1994. These classification are nationally recognized and better represent the variety and types of lands administered by BLM in Colorado. The entire listing of codes contains more detail than is necessary. We recommend the following modifications:

Recommended codes to be used that are in the SRM publication (from Great Basin descriptions):
Basin big sagebrush - 401
Mountain big sagebrush - 402
Wyoming big sagebrush - 403
Low sagebrush - 406
Other sagebrush types - 408
Juniper-pinyon woodland - 412
Salt desert shrub - 414
Riparian - 422

Other recommended codes that are not in the SRM cover types but are important to differentiate:
Mountain brush -423
Seeding - 424
Exotic annual grassland - 425
Greasewood - 426

Note: In the future, additional vegetation types could be added by consecutively numbering them after "Greasewood - 426".

DECISION - MARCH 6/7 MEETING: According to NRCS, this recommendation has already been accounted for and incorporatred in Point Module #4 for 1997.

V.A. (Land Cover/Use) Code 250 (rangeland) is inadequate to meet the variety of situations that occurs on public lands such as seedings, chainings, plowing, etc.

Recommendation: *Expand the 250 code (or make a subset) to meet needs.*

FINAL RECOMMENDATION: After discussing this issue, it was felt that these changes should be incorporated into Point Data Module X.

DECISION - MARCH 6/7 MEETING: This recommendation is covered will be incorporated into the 1997 Point Data Module#10.

V.A. (Land Cover/Use) Significant concern was voiced over the codes for forest lands (grazing). Several felt the issue was whether or not there was a herbaceous understory - not if it is grazed. Several other concerns on how forest lands are dealt with in NRI were also voiced.

Recommendation: *1) Add a code that is " 340 - Forest Land' that does not identify it as grazed or ungrazed. 2) See General Recommendation 11 that discusses the possibility of a new module. 3) Consider a similiar and approach for woodlands.*

FINAL RECOMMENDATION: Point Data Module V.A. should be modified to include a code "340" that does not identify the forest land as grazed or ungrazed. See the cover memo regarding overall recommendations on woodlands and forestry.

DECISION - MARCH 6/7 MEETING: This recommendation is adopted and will be incorporated into Point Data Module #4.

V.B-F . There doesn't seem to be a need for BLM to populate this data.

Recommendation: *Do not populate these data elements. Also see General Recommendation #5.*

FINAL RECOMMENDATION: No change in the recommendation. Do not populate this data.

DECISION - MARCH 6/7 MEETING: Accept the recommendation; these will be deleted for BLM.

V.G. (Forest Type Group) Do we add more codes for western forest types (pinon, juniper, pinon/juniper, bristlecone, limber pine, etc)?

Recommendation: *Rework this section to meet BLM's needs.*

FINAL RECOMMENDATIONS: Point Data Module V.G. should be modified to include codes for pinon, juniper, pinyon/juniper, and bristlecone pine.

AMENDED FINAL RECOMMENDATION: Revise Code 19 to the following:

19a - Woodland - pinyon, juniper, bristlecone

Definition: Forests in which pinon, juniper, or bristlecone pine comprise a plurality of cover. Common associates include scrub oakbrush.

19b - Noncommercial

Definition: This type includes types that have little or no commercial wood value. Species such as bristlecone , coulter, digger, knobcone, whitebark pines; rocky mountain juniper, and blue oak singly or in combination comprise a plurality of the cover.

DECISION - MARCH 6/7 MEETING: Accept the amended final recommendation except delete bristlecone in 19b. Include as codes for forest type groups.

V.G. (Forest Type Group) Should present natural vegetation, or potential vegetation be recorded?

Recommendation: *If module for forest land is developed, this should be considered with it. See General Recommendation 11.*

FINAL RECOMMENDATION: Point Data Module V.G. should be modified to include a code for aspen.

AMENDED FINAL RECOMMENDATION: Revise Code 20 to the following:

20a - Aspen

Definition: Forests in which aspen comprise a plurality of the cover

20b - Western Hardwoods

Definition : (same as definition in 1992 handbook except that aspen is deleted).

DECISION - MARCH 6/7 MEETING: Accept the amended final recommendation. Include as codes for forest type groups.

VI. (Distances to Habitats) Concerns were raised about the usefulness of this data. No specific recommendations.

DECISION - MARCH 6/7 MEETING: This module has been eliminated.

VIII. (Erosion Data) Concerns were raised about the time needed to collect this data. Is this to be collected for rangeland? Do we look at it qualitatively or quantitatively .

Recommendation: Talk with Pat Shaver, NRCS, and get clarification on this.

FINAL RECOMMENDATION: Based on our discussions with Pat, we recommend that this data not be gathered.

DECISION - MARCH 6/7 MEETING: This module has been eliminated.

IX. (Wetlands Data) Should FSA data be collected (it only applies to private land)? Is "Cowardin" the BLM standard? If not we will need to adopt BLMs protocol and incorporate as a data element.

Recommendation: Don't populate "B" (FSA). Coordinate with BLM wetland/riparian experts and coordinate with NRCS. Also see General Recommendation #3 regarding riparian.

FINAL RECOMMENDATION: Add no new procedures for riparian to the test at this time. Upon evaluation of the location of the PSU and related points, make final recommendations on protocol by February 28, 1997.

DECISION - MARCH 6/7 MEETING: If a point lies within a riparian area, use the NRI protocols for collecting data. Populate only the Cowardin element. This is a specific training concern.

X. (Conservation Practices) Is this data useful for a national data base? Entries need to be expanded to meet BLM needs: eg. Prescribed fire, burn/seeding, plow/seeding, etc.

Recommendation: Expand entries as noted.

FINAL RECOMMENDATION: Point Data X., should be modified to include entries that typify situations encountered on public lands administered by BLM. Examples include prescribed fire, converted rangeland (eg. trespass, drill pads, fire), exotic annual grasses, etc.

AMENDED FINAL RECOMMENDATION: Point Data X., should be modified to include entries that typify situations encountered on public lands administered by BLM:

X. CONSERVATION PRACTICES (INCLUDE THE FOLLOWING IN THE WORKBOOK):

- Land Vegetation Treatments (Rangeland)
  Definition: Land has been plowed, chained, chopped, terraced, pitted, furrowed, sprayed, or burned.
- Land Treatments (Rangeland) with Seeding
  Definition: Same as above with seeding.
- Forest/Woodland Harvest
  Definition: Clearcuts and selective thinnings.
- Tree Planting

Definition: Trees have been planted after harvesting.

* Land/Vegetation Treatment (riparian/wetlands)
Definition: Applications include burning, fencing, bank stabilization, plantings, fishery habitat improvement.

* Resource Activity Plans
Definition: Land is included in an approved resource activity plan (e.g. Allotment Management Plan, Habitat Management Plan, Forest Management Plan, Integrated Plan, Cooridinated Resource Plan, etc.)

DECISION - MARCH 6/7 MEETING: accept the amended final recommendation but provide more clarification and better definitions (i.e. vegetation treatments, seedings, harvest, plantings, riparian treatments). Resource activity plans can be populated before field work.

XI. (Conservation Treatment Needs) Serious concerns were raised by the team regarding this module. It was strongly felt that it would be unwise for BLM to populate this module for several reasons: 1) BLM (and FS) are required by law to afford full public participation and environmental reporting in making decisions on specific management actions; 2) BLM (and FS) have specific procedures on making these types of decisions, and 3) completing this element according to the protocol may create problems with interested publics and groups by creating a perception that we are being arbitrary in identifying what treatments are needed.

Recommendation: BLM should not populate this module.

FINAL RECOMMENDATION: The technical team continues to have serious concerns about populating this module for the following reasons: 1) BLM (and FS) are required by law to afford full public participation and environmental reporting in making decisions on specific management actions; 2) BLM (and FS) have specific procedures on making these types of decisions, and 3) completing this element according to the protocol may create problems with interested publics and groups by creating a perception that we are being arbitrary in identifying what treatments are needed. It has come to the attention of the team that effort is underway to amend the entries for this section to be more generic and geared to land health. The technical team strongly recommends that this modification be made and incorporated into the 1997 procedures.

DECISION - MARCH 6/7 MEETING: This module has been eliminated.

SOILS

The technical team was instructed that the expectation on the part of NRCS was that the only requirement regarding soils is to verify the soils data and to confirm the ecological site. Significant discussion followed about the concern that the soils data be adequately documented while it is being verified, that there be some mechanism for quality control of the surveys, and that appropriate data and documentation be provided for soils where there are no soils surveys. Many also felt that with very little additional money, some additional soils data could be collected that will enhance soils survey information, and complement the rangeland health data that will be gathered during the pilot.

Recommendation:
1) For the verification of soils information, the following data (which are on shown on the field methodology sheets for soil quality protocol) be collected and recorded into PDS for all points:
** Location*
** Soil Survey area Symbol*
** Soil Map Unit Symbol*
** Component Name*
** Brief Profile Description (Depth, Horizon, Texture, Hue, Values, Chroma, Effervescence, Other)*
** Root Barrier (Kind, Depth to Top)*
** Site Characteristics (Landform Position, Slope/Aspect %)*
** Climate*
** Geology/Parent Materials*

2) Coordinate with NRCS and the Soils Quality Institute to evaluate the potential to establish an

economical soil quality subsample. The technical team recommend that the following elements be considered in the evaluation:
** Depth*
** Horizon Notations*
** Texture*
** Structure (grade, size, shape)*
** Macropores*
** Zone of Maximum Bulk Density*
** OM, EC, pH*
These elements are soil quality parameters that extend beyond soils verification and would establish some baseline data upon which trend can be determined over time.

It is recommended that this be completed by December 17, 1996.

It was very clear to the team that providing adequate soils expertise is a real concern for the pilot. See #13 in the General section.

FINAL RECOMMENDATION: Maury Mausbach of NRCS's Soils Quality Institute was consulted concerning the preliminary recommendations. He concurred with recommendation. The additional time required to gather this information per point is about 30 minutes. Attachment D provides details on the data, protocol, and estimated collection times to collect soils information for this test.

DECISION - MARCH 6/7 MEETING: Approve the recomendation. By 3/14/97, Scott Davis and Al Amen will compare the recommendation with the PDA fields and identification of needed fields. BLM will supply the needed tools, pH meters, baggies, etc. for to effort. The soil samples (1000cc) will be gathered for future analysis.

FIELD METHODOLOGY

DECISION - MARCH 6/7 MEETING: See the decisions identified in "B" above. Ned Habich will compile a draft of the field methodology based on the results of the meeting. Bill Williams will provide the procedures for dealing with trees in the methodology.

RANGELAND HEALTH

DECISION - MARCH 6/7 MEETING: Approve the rangeland health proposal. Pat Sh.aver will coordinate the identification of fields needed for the PDA. One note: Assure that the additional data fields recommended for noxious weed, invasive plants, and special status plants be added to the PDAs:

10:00 - 10:30 Interagency Agreement (Eric Luse/Goebel)

Expected Outcome: Discussion on the "deliverables"

DECISION - MARCH 6/7 MEETING: NRCS is prepared to provide soils scientists for the effort, available by May 12. The role the soil scientist (i.e cres member, quality control) will be decided by March 14 (Zachman). Investigate the potential of reducing the size of the sample (Luse). Need NRCS comments to BLM by March 14 (Goebel). NRCS to provide soil survey reports, soils maps, labels for the points (Biggam?).

10:30 - 11:00 Training (Pat Shaver/Zachman)

Expected Outcome: Discuss training - schedule, mechanics, staff, etc.

DECISION - MARCH 6/7 MEETING:
* GPS/PLGR training should be joint BLM and NRCS (Zachman and Biggam on arrangements)
* Make sure a p/j site is included in the training (Zachman/Riel in consultation with Grand Jct.

BLM)
* Need handbook by end of April; outline will be developed by March 14 (Zachman/Biggam)
* Use three-ring binder so that items can easily subtracted or added.
* We will continue to have a field test of the protocols in Grand Junction April 7-11. (Zachman/Shaver)

11:00-11:30 Forest Health Inventory (Bill Williams)

Expected Outcome: Overview of plans to conduct a mini-survey to test health on forested BLM lands (not part of NRI).

DECISION - MARCH 6/7 MEETING:

11:30- 12:00 Recap of the Meeting (Malinowski/Zachman)

Expected Outcome: Review of decisions and assignments.

OTHER DECISIONS - MARCH 6/7 MEETING:

* A template of protocols will need to be developed by March 14, 1997 to show the final decisions in order for ISU to program the PDAs: core and additions (Zachman/Goebel); the rangeland health (Shaver/ Pellant), field methodology and plot design including trees (Habich/Williams).
* Amend vacancy announcement for range technician to March 28. (Zachman)
* We will use the core 1997 NRI as the base template showing additions and deletions.

APPENDIX E

DESIRED PRODUCTS

Revised 2/27/98

NATIONAL RESOURCE INVENTORY
BLM COLORADO PILOT
DESIRED PRODUCTS

DESIRED PRODUCT	DISPLAY MEDIUM 1/	SOURCE 2/	BY WHOM	COMMENTS / CONSIDERATIONS
Ecological Condition or Successional Stage	*Tables/charts (w/stats, acres) *Graphs	ISU data	BLM/NRI Tech Team	Required by law
PSU files	File Folders w/ * map *aerial photos *other maps *logistics *photos	ARC View files files files files	BLM (IRM support, soils scient., field crews)	NRCS has the prototypes for the files; once the final points have been determined, provide to IRM for assistance in generating the maps.
Vegetation Cover	Tables/charts (w/stats)	ISU data	BLM/NRI Tech team	
Rangeland Health (rangelands and woodlands with a site description)	Tables/charts (w/stats)	ISU data, the results of the forest land instrument	BLM/NRI Tech Team	To be able to identify the lands as healthy, at risk, or unhealthy; how will the 17 attributes be summarized to determine the degree of "healthyness"?; provide "red flags" for potential problems.

DESIRED PRODUCT	DISPLAY MEDIUM 1/	SOURCE 2/	BY WHOM	COMMENTS / CONSIDERATIONS
Land Classification - general and specific	Tables/charts (w/ stats, acres)	ISU data	BLM/NRI Tech Team	How many / what %s fall into the various classes.
Soils Quality	Tables/charts (w/stats)	*Soils lab reports * ISU data	BLM/NRI Tech Team, ARS	**WILL NOT BE AVAILABLE FOR THE MARCH REPORT**
Soils Quality/Veg. Condition Health Correlation	Tables/charts (w/stats)	*Soils Lab reports * ISU data	BLM/NRI Tech Team	**WILL NOT BE AVAILABLE FOR THE MARCH REPORT**
Soils Classification Verification	Tables/charts (w/stats)	?????	BLM/NRI Tech Team	Test the accuracy, reliability, and utility of the system - what happened if the soils series could not be found?; Is our level of wildland mapping satisfactory?
Trends (soils quality)	Tables/charts (w/stats)	ISU data	BLM/NRI Tech Team	Will need software that will formulate key attributes and compare between years; will be developed for use in outlying years - base data is collected in 1997.-
Weed Occurrence/Presence of Species	Tables/charts (w/stats)	ISU data	BLM/NRI Tech Team; CSO Weed Coord.	Need to include # sites that have species; identification of species needs to be noted
Fire	Table/charts (w/stats)	ISU data	BLM/NRI Tech Team ; CSO FMO	Need to identify attributes such as litter, tree size, # stems acre, etc -- formulas need to be developed. Question: Is it possible to correlate suppression w/health?

DESIRED PRODUCT	DISPLAY MEDIUM 1/	SOURCE 2/	BY WHOM	COMMENTS / CONSIDERATIONS
Wildlife habitat	Table/charts	*ISU data *Soils lab results	BLM/NRI Tech Team; CSO Wild. Bio.	Question: Is this type of information helpful?
Soil Salinity	Table/charts (w/stats)	ISU data	BLM/NRI Tech Team; CSO Soils Scientist	% of acres w/soils series that contribute to salinity problems

HEADER FOOTNOTES:

1/ - MAPS, CHARTS, TABLES, ETC.

2/ - WHERE WILL THE INFORMATION COME FROM AND HOW WILL THE INFORMATION BE GENERATED.

ABBREVIATIONS:

CSO - Colorado State Office (BLM)
FMO -Fire Management Officer
IRM - Information Resources Management
ISU - Iowa State University
NARCS -National Applied Resource Service Center (BLM)
NRCS - Natural Resources Conservation Service

DESIRED PRODUCT	DISPLAY MEDIUM 1/	SOURCE 2/	BY WHOM	COMMENTS / CONSIDERATIONS
Land Classification - general and specific	Tables/charts (w/ stats, acres)	ISU data	BLM/NRI Tech Team	How many / what %s fall into the various classes.
Soils Quality	Tables/charts (w/stats)	*Soils lab reports	BLM/NRI Tech Team	WILL NOT BE AVAILABLE FOR THE MARCH REPORT
Soils Quality/Veg. Condition Health Correlation	Tables/charts (w/stats)	*Soils Lab reports * ISU data	[illegible]	[illegible] BE AVAILABLE FOR THE MARCH [illegible]
Soils Classification Verification	Tables/charts (w/stats)	????	BLM/NRI [illegible]	Test the accuracy [illegible] what [illegible] the soils series could not be found?; [illegible] satisfactory?
Trends (soils quality)	Tables/charts (w/stats)	ISU data	BLM/NRI [illegible] CSO Soils	Will need software that will determine key attributes and compare between years; will be developed for use in outlying years - base data is collected in 1997.
Weed [illegible] of Species	Tables/charts (w/stats)	ISU data	BLM/NRI Tech Team CSO Weed [illegible]	[illegible] of species needs to be noted.
Fire	Tables/charts (w/stats)	ISU data	BLM/NRI Tech Team CSO FMO	[illegible] formulas need to be developed [illegible] possible to calculate [illegible]

APPENDIX F

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National Resources Inventory
Pilot Project Handbook

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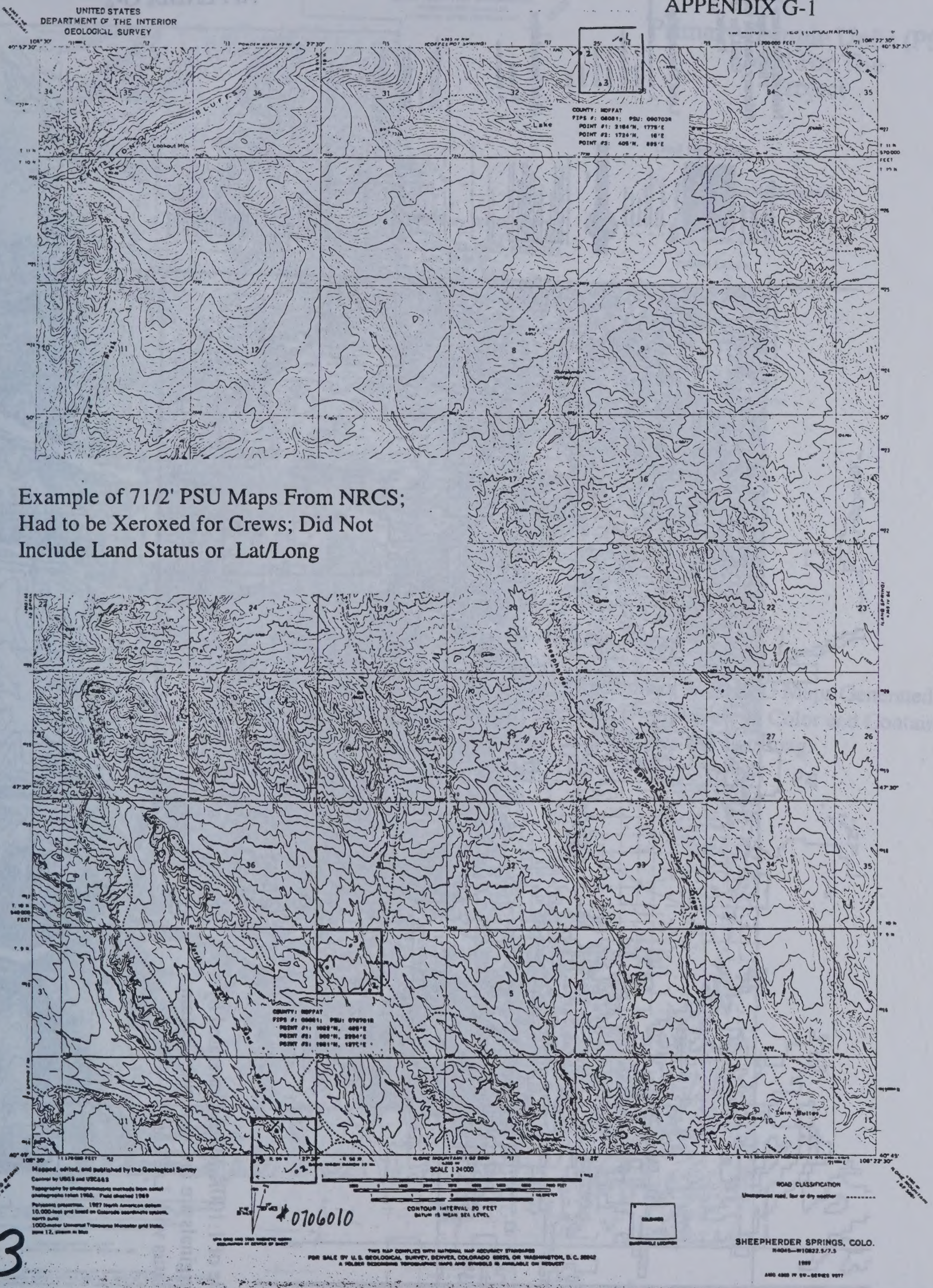
APPENDIX G

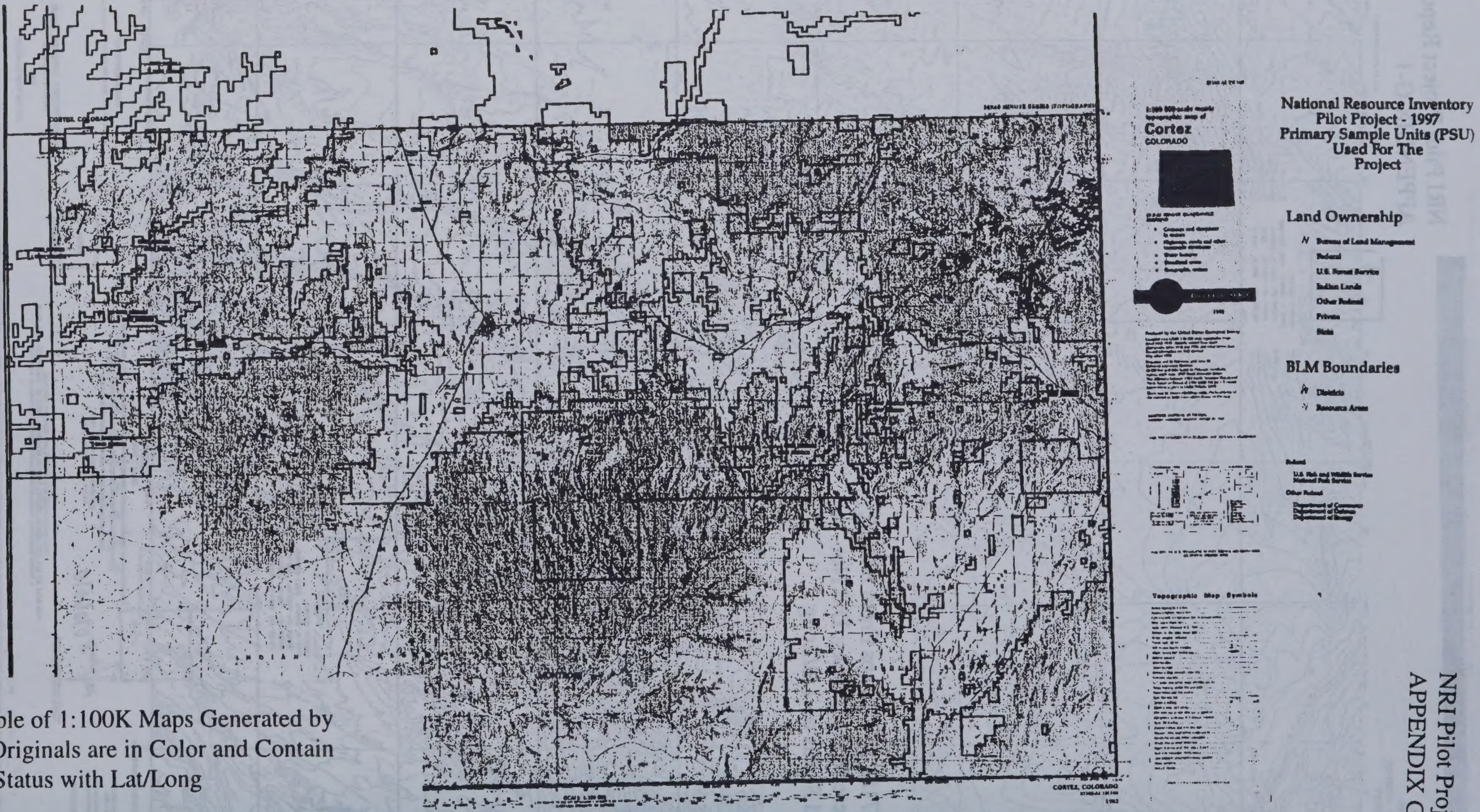
EXAMPLES
OF
MAP PRODUCTS


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COUNTY: MOFFAT
FIPS #: 08081; PSU: 090703R
POINT #1: 2164'N, 1779'E
POINT #2: 1724'N, 16'E
POINT #3: 405'N, 895'E
Lookout Mtn
BLUFFS
Lake
Twin Buttes
SCALE 1:24 000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
ROAD CLASSIFICATION
Unimproved road, fair or dry weather
SHEEPHERDER SPRINGS, COLO.
1969

Example of 71/2' PSU Maps From NRCS; Had to be Xeroxed for Crews; Did Not Include Land Status or Lat/Long

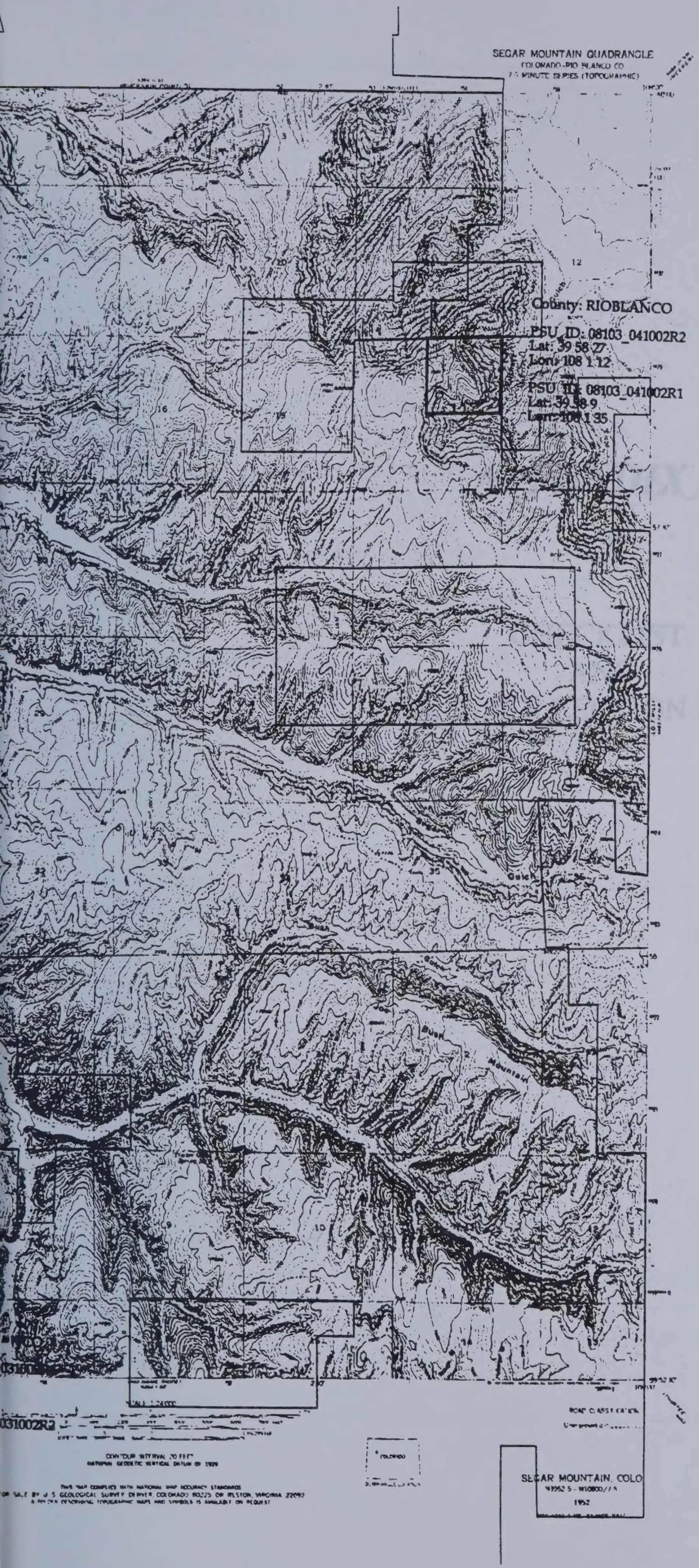
#0706010

63


National Resource Inventory
Pilot Project - 1997
Primary Sample Units (PSU)
Used For The
Project
Land Ownership
Bureau of Land Management
Federal
U.S. Forest Service
Indian Lands
Other Federal
Private
State
BLM Boundaries
Districts
Resource Areas
Federal
U.S. Fish and Wildlife Service
National Park Service
Other Federal
Department of Commerce
Department of Defense
Department of Energy
Cortez
COLORADO
CORTEZ, COLORADO
INDIAN
Topographic Map Symbols

Example of 1:100K Maps Generated by GIS; Originals are in Color and Contain Land Status with Lat/Long

NRI Pilot Project Report
APPENDIX G-3


SEGAR MOUNTAIN QUADRANGLE
COLORADO-RIO BLANCO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
County: RIOBLANCO
PSU_ID: 08103_041002R2
Lat: 39 58 27
Lon: 108 1 12
PSU_ID: 08103_041002R1
Lat: 39 58 9
Lon: 108 1 35
031002R2
SEGAR MOUNTAIN, COLO
1952

F

Primary Sample Units (PSU) Used For The Project

Land Ownership

- *N* Bureau of Land Management
- Federal
- U.S. Forest Service
- Indian Lands
- Other Federal
- Private
- State

Federal

- U.S. Fish and Wildlife Service
- National Park Service

Other Federal

- Department of Commerce
- Department of Defense
- Department of Energy

Example of 71/2' PSU Maps Generated by GIS; Originlas are in Color and Contain Land Status and Lat/Long.

APPENDIX H

CHECKLIST
AND
DATA COLLECTION FORMS

NRI FIELD CREW CHECKLIST

Task	Date Completed	Time Spent	Notes
Prework			
* 71/2 Quad Map			
* Color Quad Maps			
* Range Site description			
* Aerial Photos			
* Land Status of PSU/Points			
* Soil Survey Information - TUD, MUD, etc			
* Program PLGR			
* Forms Gathered/Pre-populated when possible			
* Plot out strategy to access site (resource area contact should assist)			
* Gather equipment, prepare vehicle			
* Contact lessess, other users, and other appropriate owners (resource area contact should take the lead in this).			
* Other (list):			
Travel to the Site			
* Vehicle travel			
* Hiking			
* Other (list):			
Locate Point with the PLGR			
Determine Ownership (Point Module 1; do if unable to do so during prework) **and Land Use** (Point Module 3). NOTE: If the point is private other agency or if land use is something other than rangeland or forest land; no further work is done at the site except to take photos to document)			
Determine if Multiple Soils and Ecological Site, Lay out Point Tapes , Pin Flags, Other Location Devices			
Take Olique Photos (3)			
* Others taken?			

NRI FIELD CREW CHECKLIST

Gather Soils Data * Photo * Pit Data on Sheets * Surface soils quality data (if completed) * Other (list):			
If Wetlands, Determine Proper Cowardin Code			
If Any Conservation Practices are Involved (chainings, terracing,etc.), Provide Appropriate Code			
Gather Vegetation Data * Cover (300 ft of canopy and basal; 60 feet ground basal; plant lists) * Production (herbaceous on 9.6 sq. ft.; woody on 96 sq.ft. Or if appropriate .01 acre) * Weeds and special plants (in 75' radius if not in the production plots) * Tree Data if Applicable (species,damage, and count) *Other (list):			
Rangeland Health			
Complete Logbook, Checklist, Other QC forms			
Travel from Site: * Vehicle travel * Hiking * Other (list):			
Follow-up Work: * Identification of unknown plants and unknown data elements) * Prepare File for Submission * Other (list):			

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 1

PSU DATA, General Information

Data Gathers

Last Name	**First Name**

Land status

Entirely BLM	**01**	
Partially BLM; Entirely Federal	**02**	
***Entirely Federal; no BLM**	**03**	
Mixture of BLM; with Private or State	**04**	
***Entirely Private/State**	**05**	
***Mixture of Private/State & Other Federal**	**06**	
***Other; list in notes section**	**07**	

* don't collect additional data!

Notes: Record notes here, including comments regarding PSU location (up to 300 Characters);________________

____

____

____

____

____

____

____

____

PSU DEVELOPMENT AREAS: use maps and aerial photos to determine; don't spend more than 15 minutes.

1. Farmsteads and Ranch Headquarters; Areas Within PSU	to Nearest 0.1 Acre	.
2. Urban and Build-up Areas, 0.25-10 Acres in Size Areas Within PSU	to Nearest 0.1 Acre	.
3. Urban and Build-up Areas, 10 or Greater Acres in Size Areas Within PSU	to Nearest 1 Acre	
4. Rural Transportation - Improved/maintained Roads Includes ditches and other disturbances associated with the construction of the road.	- Length Within PSU, to Nearest 0.1 Mile	.
	- Average Width of Disturbance in Feet	
5. Rural Transportation - Unimproved Natural Surface Roads	- Length Within PSU, to Nearest 0.1 Mile	.
	- Average Width of Disturbance in Feet	
6. Rural Transportation - Railroads	- Length Within PSU, to Nearest 0.1 Mile	.
	- Average Width of Disturbance in Feet	

Colorado BLM 1997
Test Pilot Worksheet **PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _**

Page 2

PSU SKETCH

Sketch the PSU showing farmsteads and ranch headquarters, urban buildup, rural transportation, streams, and waterbodies. Show any other important features such as power poles. Show location of points. This procedure can be accomplished by enlarging a copy of the topographic map to a minimum of 200%. Be sure to indicate Township, Range, and Meridian.

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _   _ _ _ _ _ _ _

Page 3

PSU DATA, General Information

	Segment 1	Segment 2
1 Large Streams (at least 1/8 mile wide) - Area within PSU, to nearest acre		

2. Small Stream (less than 1/8 mile wide) Use local area contacts to determine widths. Linear length can be estimated from topographic maps.

Stream	Width (feet)	Length within PSU (feet)	Stream	Width (feet)	Length within PSU (feet)
Segment 1			Segment 5		
Segment 2			Segment 6		
Segment 3			Segment 7		
Segment 4			Segment 8		

3. Large-Water bodies with at least 40 acres in total size

Waterbodies	Kind	Size Class, Total	Size Within PSU (nearest acre)
1			
2			

Kind
1. Reservoir
2. Lake

Size Class
1. Small < 100 acres
2. Medium 100-1,000 acres
3. Large > 1,000

4. Small-Waterbodies less than 40 acres in total size

Waterbodies	Total Size to Nearest 0.1 Acre	Size Within PSU to Nearest 0.1 Acre	Kind
1	.	.	
2	.	.	
3	.	.	
4	.	.	

Kind
1. Natural
2. Constructed
3. Undetermined

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _   _ _ _ _ _ _ _ _

Page 4

Point Number ☐

POINT DATA
Ownership, Use, Wetlands & Conservation Practices

DATE: _ _/_ _/1997

Last Name	First Name

1. Random Latitude		
2. Random Longitude		
3. Latitude at the point		
4. Longitude at the point		
5. Ownership indicate with X		
BLM	**01**	
***USFS**	**02**	
***Private**	**03**	
***Other**	**04**	
6. Land Cover/Use Code		
7. Forest Type Group Code		
8. Does Point Fall on Wetland or Deepwater Habitat (Indicate with x) No -Neither	**01**	
Wetland	**02**	
Deepwater Habitat	**03**	
9. Cowardin System Code 30 Riverine 40 Lacustrine		
10. Size of Wetland Basin Code <1 acre	**01**	
1-5 acre	**02**	
5-20 acres	**03**	
> 20 acres	**04**	

* If the point occurs on these lands don't collect additional data

6. Land Cover/Use Codes
250 Rangeland (ecological site description is available)
251 Rangeland - Pinyon-juniper (ecological site description is available)
252 Rangeland - Oak (ecological site description is available)
340 Forest Land (no ecological site description is available)
Barren Land Codes
611 Salt Flats
612 Bare Exposed Rock
613 Stripe Mine Quarries
614 Beaches
615 Sand Dunes
616 Mixed Barren Lands
617 Mud Flats
618 River Wash
619 Oil Waste Land
620 Other Barren Land
Other codes
700 Urban and build-up areas 10 acres or larger
730 Small Urban and buildup areas .25 to 1 acre

911 Waterbody 2 to 40 Acres
902 Waterbody less than 2 Acres
911 Perennial Stream less than 66 Feet Wide
912 Perennial Stream 66 to 660 Feet Wide
913 Perennial Stream less than 1/8 Mile

7. Forest Type Group Codes
11 Douglas Fir
13 Ponderosa Pine
15 Lodgepole Pine
17 Fir-Spruce in this type
19 Noncommercial
20 Western Hardwood
21 Pinyon/Juniper
22 Aspen

Conservation practices -- Indicate all that are appropriate with X								
None of the following	00		Sprayed	07		Planned Grazing Use	14	
Plowed	01		Burned	08		Bank Stabilization	15	
Chained	02		Seeded	09		Habitat Improvement (fishery)	16	
Chopped	03		Clear-cut	10		Diversion	17	
Terraced	04		Selective Harvested	11		Activity/Management Plan	18	
Pitted	05		Planted (trees)	12				
Furrowed	06		Fenced	13				

PSU NUMBER_ _ _ _ _   _ _ _ _ _ _ _ _

POINT NUMBER ☐

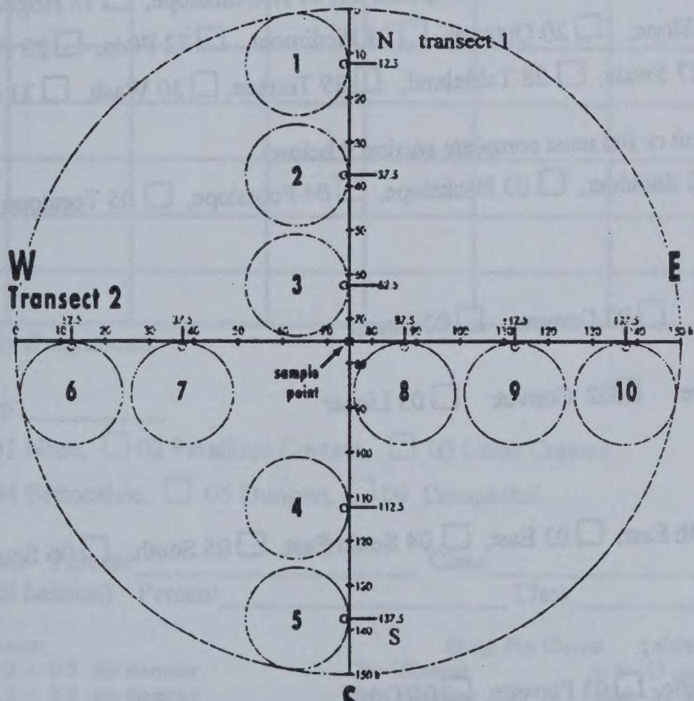
ECOLOGICAL SITES

Ecological site 1 (at point) Name ______________________________
Number ______________________________

Does any portion of either transect fall on a different ecological site. Yes ☐ No ☐

If yes draw a sketch showing the location of the boundary, the name of the sites, the location of transect extensions, the location of soil pits, the location of additional plots, and any other important features.

Ecological site 2 Name ______________________________
Number ______________________________


N
transect 1
W
Transect 2
E
S
1
2
3
4
5
6
7
8
9
10
sample point
12.5
37.5
62.5
87.5
112.5
137.5
150

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _

Page 6

POINT NUMBER ☐ SITE 1 or 2 (CIRCLE)

SOILS DATA
BACKGROUND INFORMATION

Soil Survey Area Symbol _ _ _ _ _   Soil Map Unit Symbol _ _ _ _ _ _   S5ID _ _ _ _ _ _

Soil Taxanomic Classification____

Enter soil taxonomix classifcation if soil series S5ID is not entered.

Soil Component Name (60Characters)_ _

☐ 01Named Map Unit Component, ☐ 02 Named Inclusion, ☐ 03 Unnamed Inclusion

Ecological Site Number_________________________ Ecological Site Name_________________________

☐ 01 Fits the Ecological Site Description, ☐ 02 Marginally Fits the Site Description, ☐ 03 Does Not Fit the Site Description

SETTING

1. Elevation (feet): ______________
2. Mean Annual Precipitation (Range in inches)________to__________
3. Frost Free Period (Range in days)________to__________
4. Landform (Check one)

☐ 01 Badland, ☐ 02 Basin, ☐ 03 Bench (structural), ☐ 04 Breaks, ☐ 05 Bluffs, ☐ 06 Butte, ☐ 07 Cliff, ☐ 08 Cove, ☐ 09 Cuesta , ☐ 10 Dune, ☐ 11 Escarpment, ☐ 12 Fan, ☐ 13 Floodplain, ☐ 14 Hill-hillslope, ☐ 15 Hogback, ☐ 16 Knoll, ☐ 17 Marsh/Bog, ☐ 18 Mesa, ☐ 19 Mountain Slope, ☐ 20 Outcrop, ☐ 21 Piedimont, ☐ 22 Plain, ☐ 23 Plateau, ☐ 24 Playa, ☐ 25 Ridge, ☐ 26 Side Slope, ☐ 27 Swale, ☐ 28 Tableland, ☐ 29 Terrace, ☐ 30 Wash, ☐ 31 Other_________

5. Landscape Position (Check one)(if other than summit or flat must complete section 9 below)

Hillslope and Sideslope: ☐ 01 Summit, ☐ 02 Shoulder, ☐ 03 Backslope, ☐ 04 Footslope, ☐ 05 Toeslope

Terrace: ☐ 06 Riser, ☐ 07 Tread

Flat: ☐ 08 Flat

6. Vertical Slope Shape (Check one): ☐ 01 Concave ☐ 02 Convex ☐ 03 Linear

7. Horizontal Slope Shape (Check one): ☐ 01 Concave ☐ 02 Convex ☐ 03 Linear

8. Slope gradient (%)________

9. Slope Aspect (Check one): ☐ 01 North, ☐ 02 North East, ☐ 03 East, ☐ 04 South East, ☐ 05 South, ☐ 06 South West, ☐ 07 West, ☐ 08 North West

10. Plot microtopographic description (Check all applicable):
☐ 01 Shrub-Coppice Dune/Intercoppice, ☐ 02 Terracette, ☐ 03 Playette, ☐ 05 Other_____________________

11. Soil pit microtopographic position (Check one):
☐ 01 Shrub-Coppice Dune, ☐ 02 Coppice bench, ☐ 03 Intercoppice, ☐ 04 Terracette, ☐ 05 Playette, ☐ 07 Other__________

12. Soil pit surface cover (Check one): ☐ 01 Bare, ☐ 02 Litter, ☐ 03 Cryptogam (moss/lichen), ☐ 04 Grass, ☐ 05 Shrub

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

POINT NUMBER ☐ SITE 1 or 2 (CIRCLE)

PARENT MATERIAL AND GEOLOGY

Parent Material (Check one for each line)

1. Kind: ☐ 01 Alluvium, ☐ 02 Colluvium, ☐ 03 Eolian, ☐ 04 Mixed, ☐ 05 Residuum, ☐ 06 Glacial, ☐ 07 Organic
2. Texture: ☐ 01 Sandy, ☐ 02 Loamy, ☐ 03 Clayey
3. Reaction: ☐ 01 Acidic, ☐ 02 Alkaline, ☐ 03 Calcareous, ☐ 04 Noncalcareous, ☐ 05 Saline

Bedrock:

1. Type (Select one):
   Sedimentary: ☐ 01 Sandstone, ☐ 02 Shale, ☐ 03 Limestone, ☐ 04 Conglomerate, ☐ 05 Other ____________
   Igneous: ☐ 06 Granite, ☐ 07 Basalt, ☐ 08 Rhyolite, ☐ 09 Other ____________
   Metamorphic: ☐ 10
2. Reaction (Select one): ☐ 01 Acidic, ☐ 02 Alkaline, ☐ 03 Calcareous, ☐ 04 Noncalcareous, ☐ 05 Saline

SOIL IDENTIFICATION AND VERIFICATION

Brief Profile Description to 60 inches (40 inches is sufficient)

Depth	Horizon	Modifier Texture		Color			Effervesc	*EC	*pH
				Hue	Value	Chroma			
0 to									
to									
to									
to									
to									
to									

* Populate with data only if significant

Root Barrier depth to top: __________

Type (Select one): ☐ 01 None, ☐ 02 Paralithic Contact, ☐ 03 Lithic Contact,
☐ 04 Petrocalcic, ☐ 05 Duripan, ☐ 06 Compacted

Rock Fragments (Surface) Percent____________________ Class____________________

Rock Fragments (Control Section) Percent____________________ Class____________________

Shape-Round Classes		Shape-Flat Classes	
GRF - Fine Gravel	0.2 - 0.5 cm diameter	CN - Channer	0.2 - 15 cm long
GRM - Medium Gravel	0.5 - 2.0 cm diameter	FL - Flagstone	15.0 - 38 cm long
GRC - Coarse Gravel	2.0 - 7.6 cm diameter	STF - Stone	38.0 - 60 cm long
CB - Cobble	7.6 - 25.0 cm diameter	BYF - Boulder	> 60 cm long
ST - Stone	25 - 60.0 cm diameter		
BY - Boulder	> 60 cm diameter		

Notes: ____

____

____

____

____

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _

Page 8 **POINT NUMBER** ☐ **SITE 1 or 2 (CIRCLE)**

SOILS INFORMATION

NEAR SURFACE MORPHOLOGY to 30 cm (For Soil Quality)

Depth	Horizon	%Clay	Water State	Structure			Moisture Rupture Resistance	*EC	*pH
				Grade	Size	Shape			
0 to									
to									
to									
to									
to									
to									

*Optional Data

------------------------------Structure------------------------------

Water State	
D	Dry
SM	Slightly Moist
MM	Mod. Moist
VM	Very Moist
W	Wet

Grade
1 Weak
2 Moderate
3 Strong

Size		(if platty)
vf -	very fine	(very thin)
f -	fine	(thin)
m -	medium	(medium)
c -	coarse	(thick)
vc -	very coarse	(very thick)

Shape	
gr	- granular
sbk	- sub-angular blocky
abk	- angular blocky
pl	- platy
pr	- prismatic
cpr	- columnar
m	- massive
sg	- single grained

Moist Rupture Resistance	
L	- Loose
VFr	- Very Friable
Fr	- Friable
Fi	- Firm
Vfi	- Very Firm
EFi	- Extremely Firm

Zone of Maximum Bulk Density in top 30 cm:_____**to**_____**cm**

CRUST DESCRIPTION

Type (check all that apply): ☐ 01 Lichen, ☐ 02 Moss, ☐ 03 Mineral/other, ☐ 04 None

Complete the following section for mineral crust only...

Dry color:_______________ Thickness (mm):______

Dry Rupture Resistance (Select one): ☐ 01 Weak, ☐ 02 Moderate, ☐ 03 Strong, ☐ 04 Extremely Strong, ☐ 05 Too Wet,

Crust particle size class (check one): ☐ 01 Sandy, ☐ 02 Loamy, ☐ 03 Clayey

SOIL SAMPLES COLLECTED

Identify which soil samples were collected at the PSU-sample point

☐ 01 Primary Soil Sample - Soil Pit (0-5cm),

☐ 02 Soil quality transect samples (0-2.5 and 2.5-10 cm)
Composite by Cover Strata (Grass/Shrub/Tree/Bare)

NOTES: ____

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _

Page 9

POINT NUMBER ☐ **SITE 1 or 2 (CIRCLE)**

SOILS INFORMATION

SOILS TRANSECT SOIL QUALITY TEST + SAMPLING
Distance from transect line______(ft)

Transect	Distance	Cover Strata	Microtopo Unit	0 - 5 mm			20 - 25 mm		
				Start	Sieve	Class	Start	Sieve	Class
1 (N-S)	0			0:00	5:00		2:00	7:00	
1	20			0:15	5:15		2:15	7:15	
1	40			0:30	5:30		2:30	7:30	
1	60			0:45	5:45		2:45	7:45	
1	90			1:00	6:00		3:00	8:00	
1	110			1:15	6:15		3:15	8:15	
1	130			1:30	6:30		3:30	8:30	
1	150			1:45	6:45		3:45	8:45	
2 (W-E)	0			0:00	0:50		2:00	7:00	
2	20			0:15	5:15		2:15	7:15	
2	40			0:30	5:30		2:30	7:30	
2	60			0:45	5:45		2:45	7:45	
2	90			1:00	6:00		3:00	8:00	
2	110			1:15	6:15		3:15	8:15	
2	130			1:30	6:30		3:30	8:30	
2	150			1:45	6:45		3:45	8:45	

Cover * Strata (Ranked by preference)

(1)________________

(2)________________

(3)________________

(4)________________

*all area of plot must fit into one strata. Strata must be ranked. Points with overlapping strata assigned strata with highest rank. Standard;grass/shrub/tree/bare

Microtopo Units

1. Coppice
2. Coppice bench
3. Intercoppice
4. Terracette Playette
5. Other____________

Class	Criteria for assignment to stability class
0	Soil to unstable to sample (fall through sieve)
1	50% of structual integrity lost within 5 seconds of insertion
2	50% of structual integrity lost within 5- 30 seconds after insertion
3	50% of structual integrity lost within 30- 300 seconds after insertion
4	0-25% of soil remaining on sieve after 5 dipping cycles
5	>25-75% of soil remaining on sieve after 5 dipping cycles
6	>75-110% of soil remaining on sieve after 5 dipping cycles

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Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 10

POINT NUMBER ☐

COVER - 15 FEET SEGMENTS

Transect ___________

Segment 1

Code	BASAL		GROUND LEVEL				Code	BASAL		GROUND LEVEL			
	From	To	Bare	Litter	M.C.	Rock		From	To	Bare	Litter	M.C.	Rock

Segment 2

Code	BASAL		GROUND LEVEL				Code	BASAL		GROUND LEVEL			
	From	To	Bare	Litter	M.C.	Rock		From	To	Bare	Litter	M.C.	Rock

HEIGHT

CODE	AVERAGE HEIGITH	TALLEST	SHORTEST		CODE	AVERAGE HEIGHT	TALLEST	SHORTEST

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Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _   _ _ _ _ _ _ _ _ _

Page 10a (Optional)

POINT NUMBER ☐

COVER - 15 FEET SEGMENTS

Transect __________

Segment #:

Code	BASAL		GROUND LEVEL				Code	BASAL		GROUND LEVEL			
	From	To	Bare	Litter	M.C.	Rock		From	To	Bare	Litter	M.C.	Rock

HEIGHT

CODE	AVERAGE HEIGTH	TALLEST	SHORTEST		CODE	AVERAGE HEIGHT	TALLEST	SHORTEST

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Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 11

POINT NUMBER ☐

COVER - 50 FEET SEGMENTS

Transect __________

Segment 1

	BASAL			CANOPY						CANOPY				
Code	From	To	Open	Grass	Forb	Shrub	Tree	Succ	Open	Grass	Forb	Shrub	Tree	Succ

Segment 2

Code	BASAL			CANOPY						CANOPY				
	From	To	Open	Grass	Forb	Shrub	Tree	Succ	Open	Grass	Forb	Shrub	Tree	Succ

WOODY SPECIES CANOPY INTERCEPT USING NORTH/SOUTH TRANSECT FROM 0-50 FT AND 100-150 FT. ENTER SPECIES CODE ON FIRST ROW LINE

COLORADO NRI PILOT
VEGETATION PRODUCTION WORKSHEET
Page 12

PSU NO. __ __ __ __ __ __ __ __ __ __ __ __ PAGE ___ OF __
Point NO._____ SITE 1 or 2 (CIRCLE)

ESTIMATED WEIGHT UNITS BY SPECIES

		<----(2)---->														<---- ADJUSTMENTS			---->	<---- DOUBLE SAMPLING		---->	
PLANT SPECIES SYMBOL (1)	PLANT SPECIES COMMON NAME (OPTIONAL)	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	TOTAL WT UNITS (3)	WT UNIT WT (4)	WT MEAS gm/lb (5)	PLOT SIZE (6)	PLOT SIZE CF (7)	ADW ADJ (8)	UTIL ADJ (9)	GWTH ADJ (10)	CLIP PLOTS EST WT (11)	CLIP PLOTS CLIP WT (12)	CLIP/ EST CF (13)	TOTAL WEIGHT LB/AC (14)
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REMARKS:

Colorado BLM 1997
Test Pilot Worksheet **PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _**

Page 13 **POINT NUMBER** ☐ **SITE 1 or 2 (CIRCLE)**

TREE DATA

Plot #	SPECIES	DAMAGE		TREE COUNT BY HEIGHT CLASS			
		Code	Severity	<2'	2' - 6'	6' - 16'	>16'

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _

POINT NUMBER ☐

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RANGELAND HEALTH

Ecological Site 1 Name______________________ Ecological Site 2 Name ______________________

Enter class numbers I, II, III, IV, or V to each attribute

Ecological Site 1

Attribute		Class
Rills	1	
Water Flow Patterns	2	
Pedestals Caused by Erosion	3	
Bare Ground	4	
Gullies	5	
Wind Erosion	6	
Cryptobiotic Crust	7	
Soil Surface	8	
Infiltration & Runoff	9	
Plant Mortality	10	
Functional Plant Groups	11	
Litter Distribution	12	
Litter Amount	13	
Plant Stress	14	
Production	15	
Invasive Plants	16	
Recruitment & Reproduction	17	

Ecological Site 2

Attribute		Class
Rills	1	
Water Flow Patterns	2	
Pedestals Caused by Erosion	3	
Bare Ground	4	
Gullies	5	
Wind Erosion	6	
Cryptobiotic Crust	7	
Soil Surface	8	
Infiltration & Runoff	9	
Plant Mortality	10	
Functional Plant Groups	11	
Litter Distribution	12	
Litter Amount	13	
Plant Stress	14	
Production	15	
Invasive Plants	16	
Recruitment & Reproduction	17	

SPECIAL STATUS PLANTS - NAME	ABUNDANCE
01	
02	
03	
04	
05	

NOXIOUS & INVASIVE PLANTS - NAME	ABUNDANCE
01	
02	
03	
04	
05	

APPENDIX I

TRANSECT DESIGN

NRI PLOT

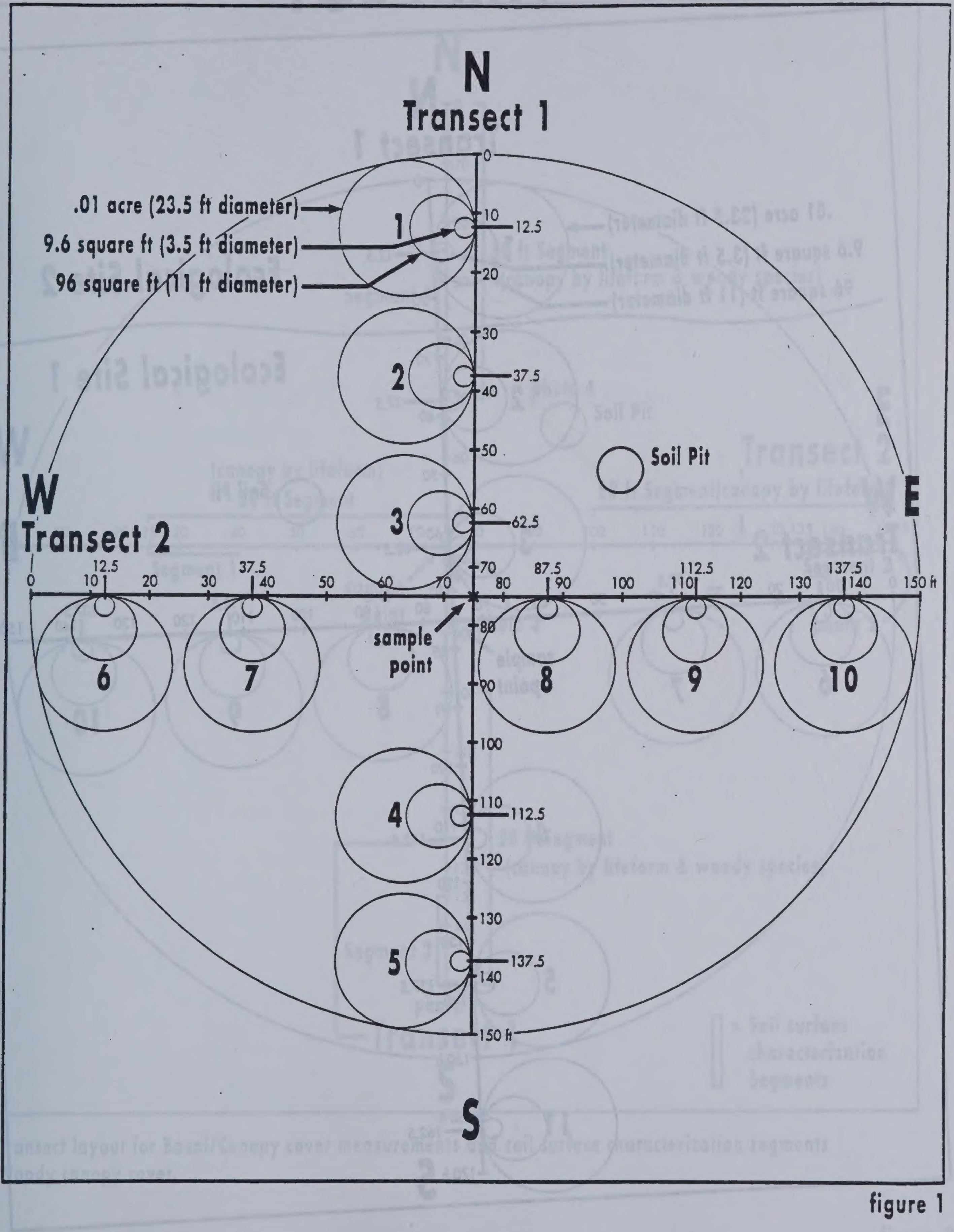

N
Transect 1
.01 acre (23.5 ft diameter)
9.6 square ft (3.5 ft diameter)
96 square ft (11 ft diameter)
0
10
12.5
20
30
37.5
40
50
60
62.5
70
80
90
100
110
112.5
120
130
137.5
140
150 ft
1
2
3
4
5
Soil Pit
W
Transect 2
E
0
10
12.5
20
30
37.5
40
50
60
70
80
87.5
90
100
110
112.5
120
130
137.5
140
150 ft
6
7
8
9
10
sample point
S

figure 1

NRI PLOT

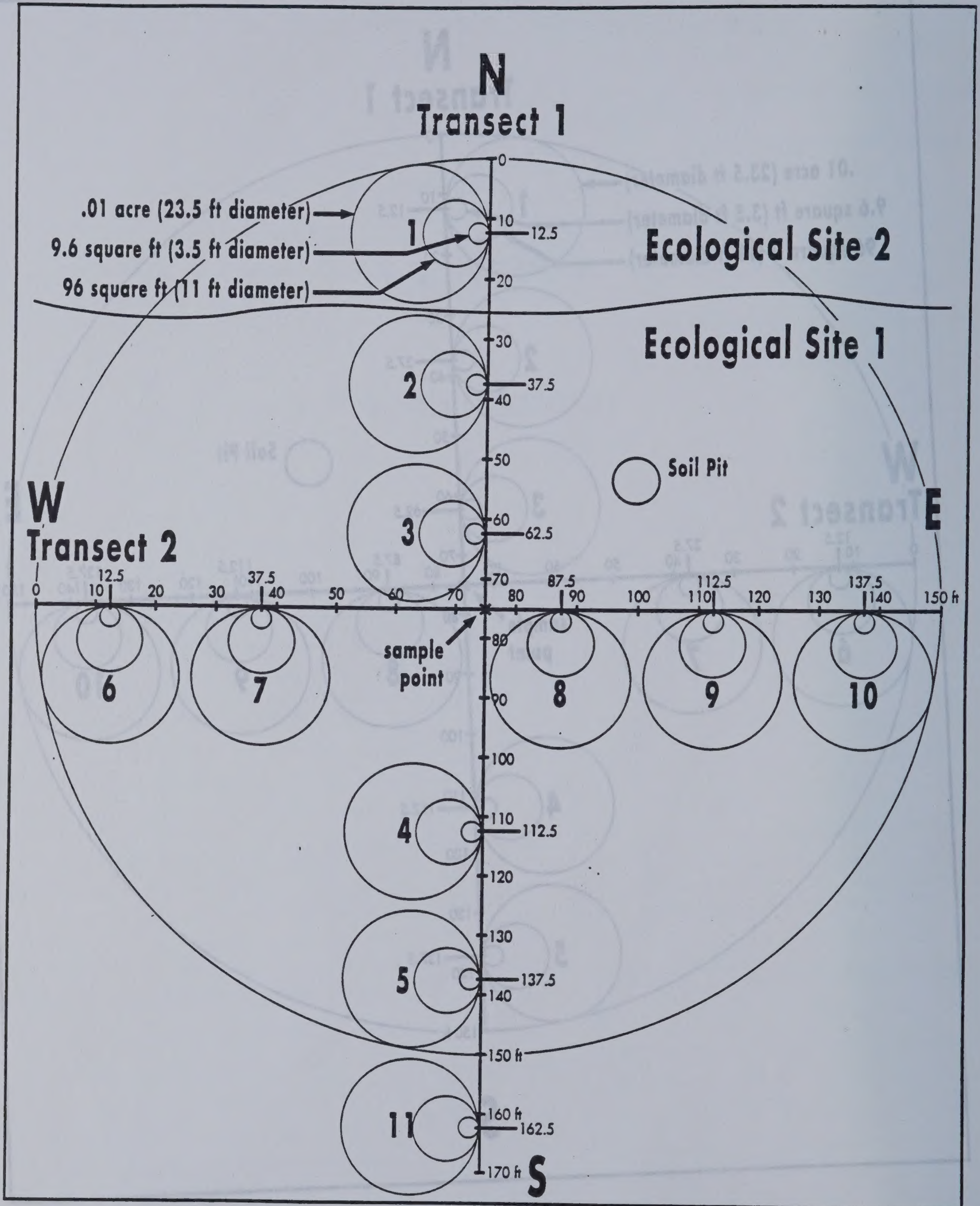
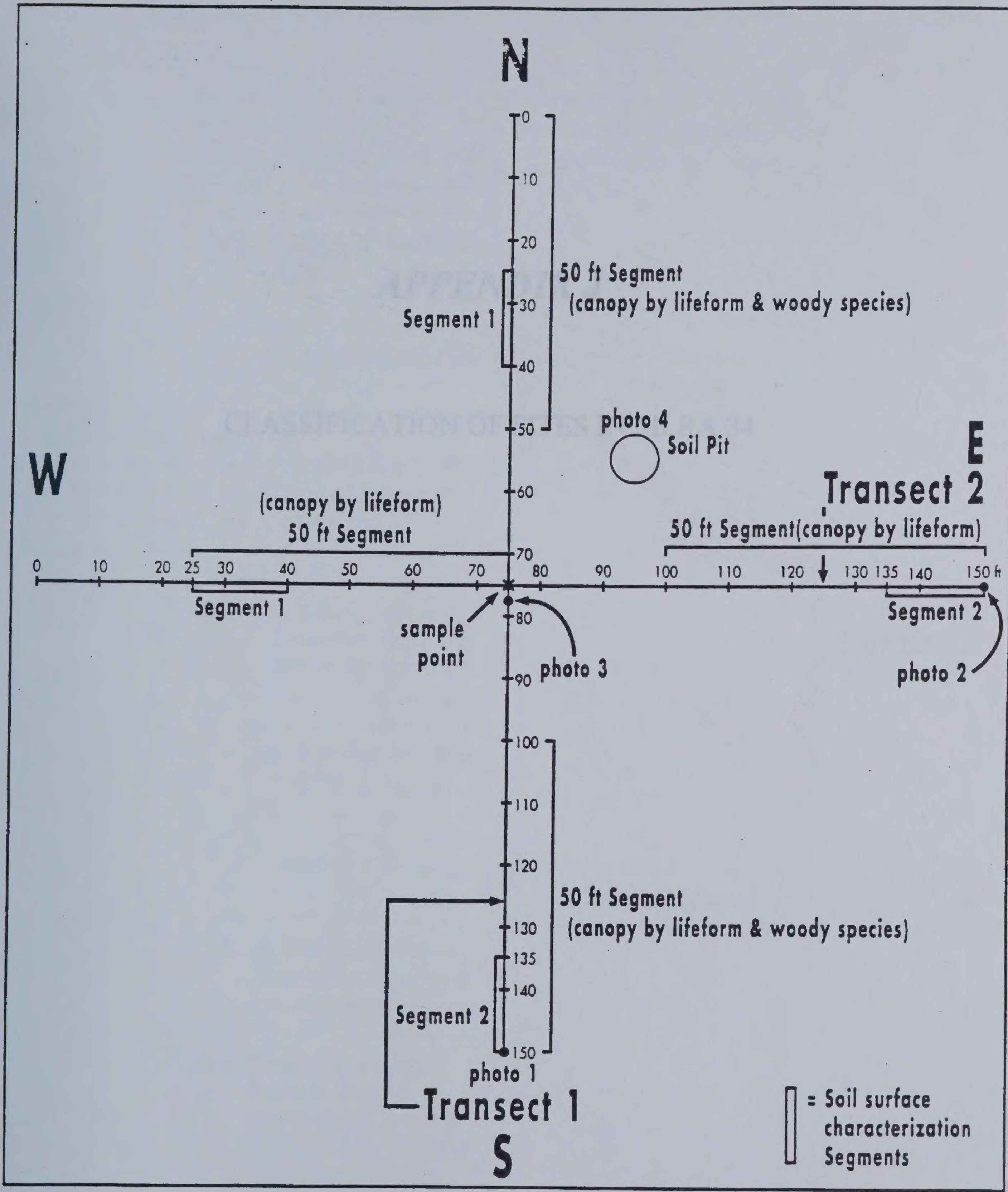

N
Transect 1
.01 acre (23.5 ft diameter)
9.6 square ft (3.5 ft diameter)
96 square ft (11 ft diameter)
Ecological Site 2
Ecological Site 1
Soil Pit
W
Transect 2
E
sample point
S
1
2
3
4
5
6
7
8
9
10
11
0
10
12.5
20
30
37.5
40
50
60
62.5
70
80
87.5
90
100
110
112.5
120
130
137.5
140
150 ft
160 ft
162.5
170 ft

figure 2

NRI PLOT—Cover


N
0
10
20
50 ft Segment
(canopy by lifeform & woody species)
Segment 1
30
40
50
photo 4
Soil Pit
E
W
60
Transect 2
(canopy by lifeform)
50 ft Segment
50 ft Segment(canopy by lifeform)
70
0
10
20
25
30
40
50
60
70
80
90
100
110
120
130
135
140
150 ft
Segment 1
Segment 2
sample point
80
photo 3
photo 2
90
100
110
120
50 ft Segment
(canopy by lifeform & woody species)
130
135
140
Segment 2
150
photo 1
Transect 1
S
= Soil surface characterization Segments

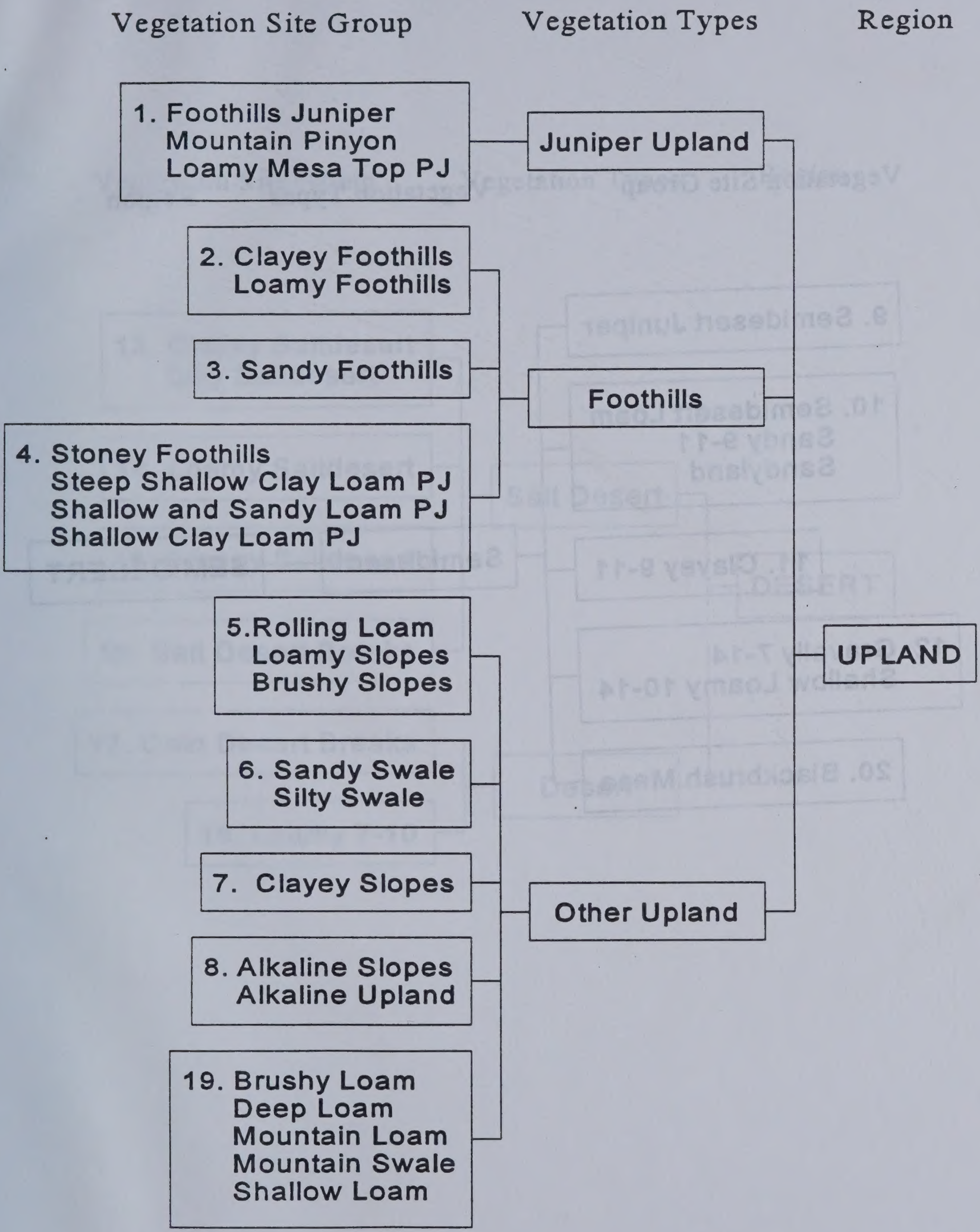
Transect layout for Basal/Canopy cover measurements and soil surface characterization segments
Woody canopy cover.

figure 3

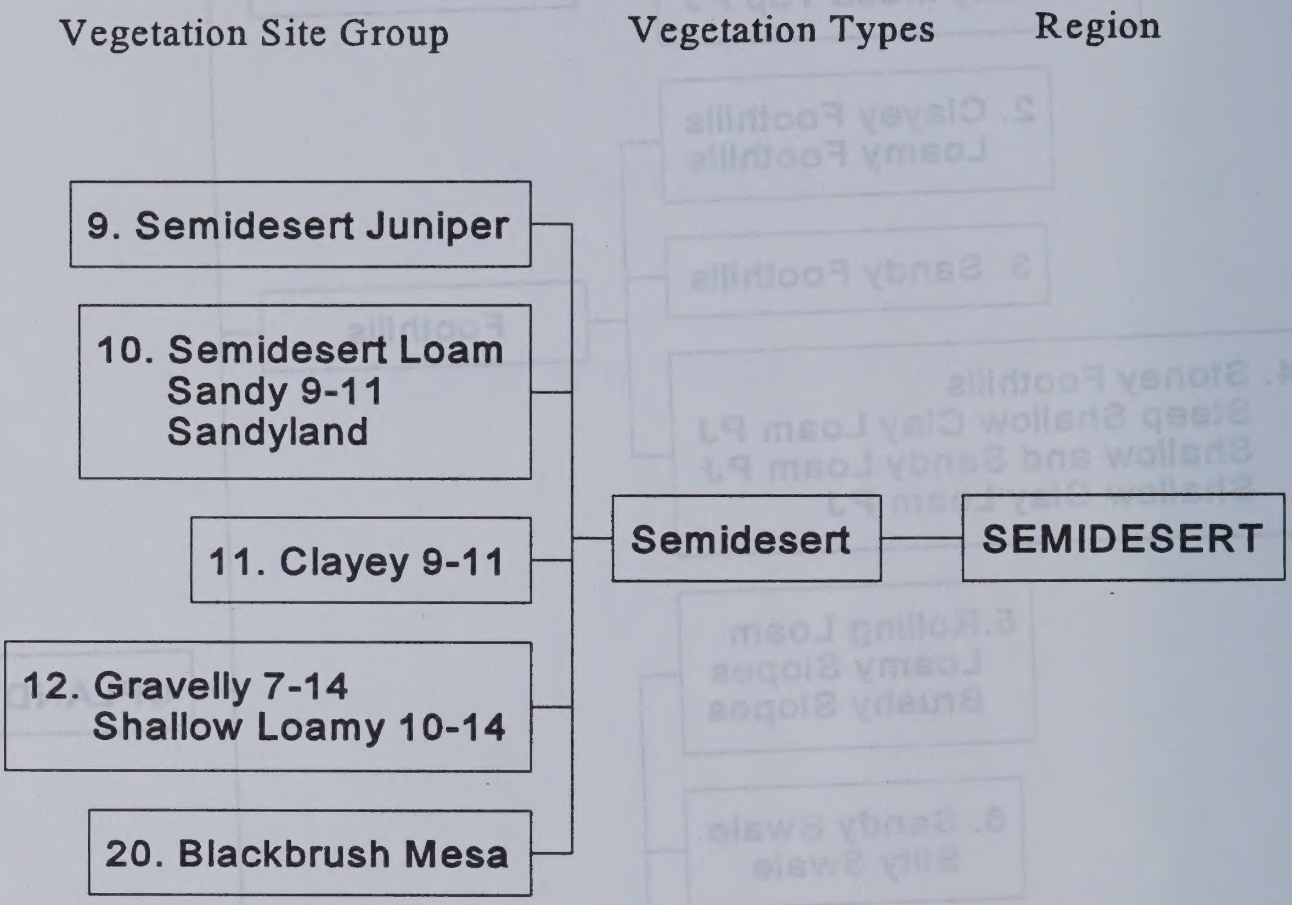
APPENDIX J

CLASSIFICATION OF SITES IN MLRA 34

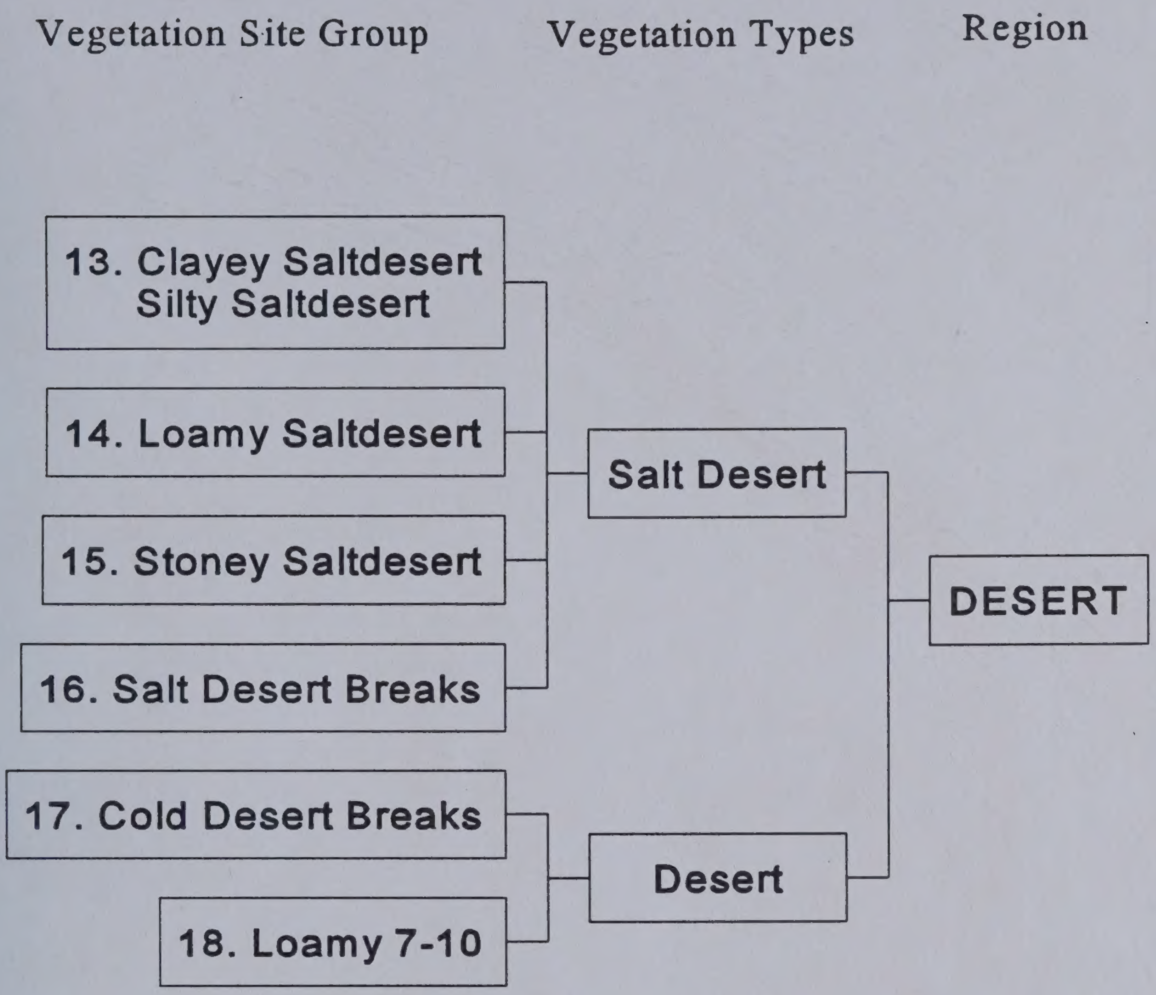
Appendix J:
Classification of Sites in MLRA-34


Vegetation Site Group
Vegetation Types
Region
1. Foothills Juniper
Mountain Pinyon
Loamy Mesa Top PJ
Juniper Upland
2. Clayey Foothills
Loamy Foothills
3. Sandy Foothills
Foothills
4. Stoney Foothills
Steep Shallow Clay Loam PJ
Shallow and Sandy Loam PJ
Shallow Clay Loam PJ
5.Rolling Loam
Loamy Slopes
Brushy Slopes
UPLAND
6. Sandy Swale
Silty Swale
7. Clayey Slopes
Other Upland
8. Alkaline Slopes
Alkaline Upland
19. Brushy Loam
Deep Loam
Mountain Loam
Mountain Swale
Shallow Loam

Appendix J:
Classification of Sites in MLRA-34


Vegetation Site Group
Vegetation Types
Region
9. Semidesert Juniper
10. Semidesert Loam
Sandy 9-11
Sandyland
11. Clayey 9-11
12. Gravelly 7-14
Shallow Loamy 10-14
20. Blackbrush Mesa
Semidesert
SEMIDESERT

Appendix J:
Classification of Sites in MLRA-34


Vegetation Site Group
Vegetation Types
Region
13. Clayey Saltdesert Silty Saltdesert
14. Loamy Saltdesert
15. Stoney Saltdesert
16. Salt Desert Breaks
17. Cold Desert Breaks
18. Loamy 7-10
Salt Desert
Desert
DESERT